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JULY, 1894.

Whole No. 12.

PROCEEDINGS

3309

OF THE

American Gas Light Association.

.....189.....

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THE STORAGE AND MEASUREMENT OF
ENRICHING OILS.*

A PAPER READ TO THE NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
BOSTON, MASS., FEBRUARY 21, 1894.

By enriching oils, reference is made to petroleum and to petroleum distillates. Inflammable, volatile, and valuable, these oils cannot be transported and stored without risk of serious loss and damage, unless continual care be allied with good construction. The commerce of to-day, by exchanging petroleum in barrel lots, reminds us of the earliest system of storage, and a great quantity of oil is still handled in wooden tanks and barrels. At some gas works the shipments arrive in this form. The friendly relation between wood and oil is easily intensified into a very ardent glow, if the needed match can be arranged ; but always the best proceeding is to divorce the oil from every form of wooden vessel, however little convenience or cheapness may favor such a separation. The present low costs of iron and steel construction make it more easily possible to build a storage or supply tank that shall be time-enduring and oil-tight.

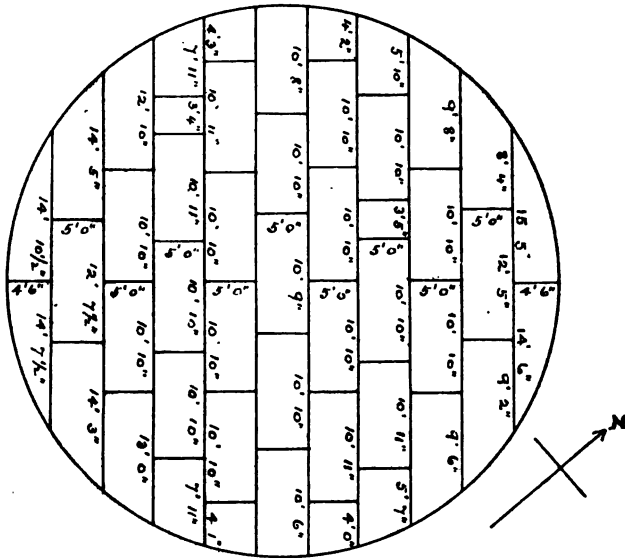
* For the cuts used in illustrating this article, we are indebted to the American Gas Light Journal.

In the oil regions the storage tanks are placed directly upon the ground, which has been carefully leveled to receive them. In some places the statute law may require certain forms of construction to be observed, as that each tank shall be set in a brick or concrete pit or basin having a capacity sufficient to hold the contents of the filled tank. Or the fire insurance companies may regulate the location of the tanks, and prescribe every detail of fitting and construction; as in Chicago, where the oil tanks for boiler fuel must be in underground vaults. In a gas works, to have an oil tank set within a building of brick and iron would rob of many terrors the Fourth of July, and every other thunderstorm. But the expense of a brick guardhouse is a formidable item.

Some years ago it was suggested that the oil storage tank could be built within the gasholder pit, thus to utilize idle excavation and to economize in ground space; but the necessity must be indeed imperative which would resort to this plan. It is better to have the tank easily accessible, and to keep watch on the tank and contents, than to bury them under the water or under the ground, and then to imagine that the danger is buried with them, or even thereby made less grave. If the bottom of the tank is to be below the ground level and the water line, ascertain how much water will float the tank, that the connections may be cared for and not ruptured when the tank is empty. It may cause surprise to find an empty oil tank, 40 feet in diameter by 20 feet in height, afloat in 3 or 4 inches depth of water. The tighter the tank and the greater the diameter, the more necessary this precaution. Many tanks are set above the ground, on a number of brick piers; here both tanks and piers are usually small. If the tank is to be set, without foundation, upon the ground, have the surface leveled with much care. If the ground is moist and yielding, a layer of clean gravel will be an effective aid. In a soil so soft that, by hand, an iron bar could be sunk through it 10 feet without much resistance, it was found that 150 tons of gravel, distributed in a rolled layer 9 inches deep, thus covering a space 58 feet square, furnished a stable platform for a tank 54 feet in diameter by 32 feet high (10,000 barrel tank). The gravel was heavily rolled, while wet, and two thicknesses of 2-inch hemlock (tarred, with ends cut to radius of 28 feet)

were laid upon the leveled bed. Exact measurements show that this tank has settled very little, and nearly even, under a weight of 2,000 tons of water and oil.

FIGURE 1.

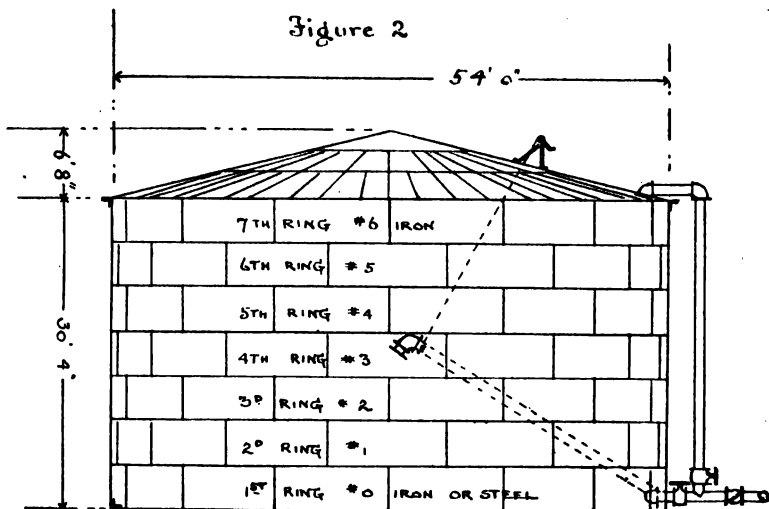


BOTTOM PLATES ROUGH-ROLLED, PLANED, BEVELED AND
CAULKED INSIDE AND OUTSIDE, OF № 6 IRON OR STEEL.
BOTTOM JOINTS SINGLE RIVETED RIVETS 3/8" DIAM., 1 1/4" PITCH.
BOTTOM ANGLE-IRON 3" x 3 1/2" x 5/8", BOTH EDGES BEVELED
AND CAULKED; RIVETS 5/8" DIAMETER x 2" PITCH.
BOTTOM TESTED AND TIGHT UNDER 5" WATER.

The capacity required and the strength of the materials to be used make the several dimensions of the tank and of its parts a matter of quick computation. But no figuring, however accurate, will satisfactorily build the tank or keep it tight. Have the plates smooth rolled and planed beveled before delivery, that every riveted joint may be caulked inside and outside. When the plates are received, determine with a gauge whether they are of the specified thickness; and examine all iron work for general appearance, lamination, and sand or slag blister. The rivet holes in all plates should come to a neat fit; the use

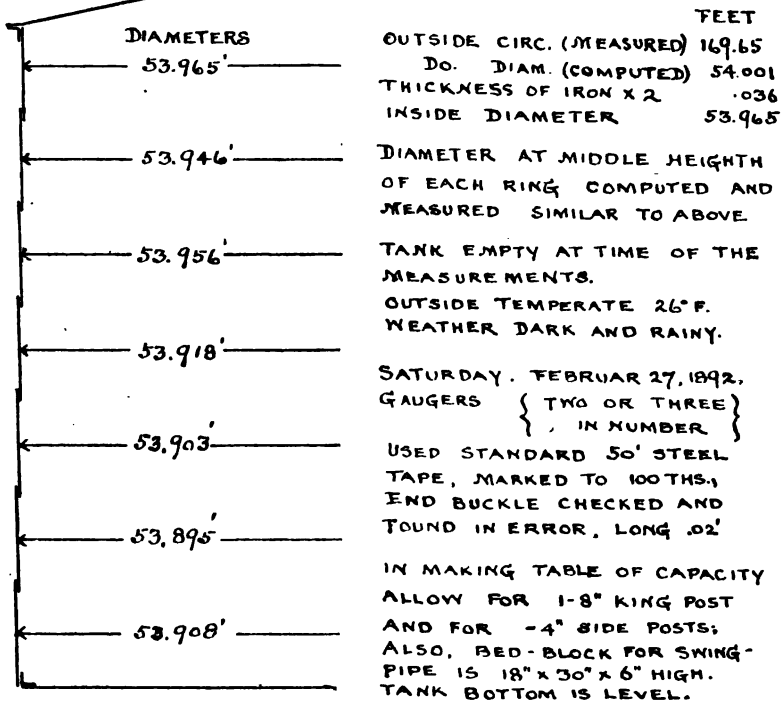
of the drift-pin means a special strain on a rivet which cannot properly fill the rivet hole. The time to make an oil tank tight is when it is building, not afterwards; and the detailed inspection of the work, while in progress, will often save a possible subsequent loss of time and oil.

The bottom plates are always light, and they are riveted together with the dispatch which means that this part of the tank will be out of sight when the tank is filled with oil. When the bottom is tested under a few inches of water, preparatory to lowering to bed, insist upon actual tightness. Boiler makers think that a joint may "sweat," and they always predict that it will rust tight. Accept no "sweats." Let the bottom be really tight when lowered to place. In recognition of the utility of a working drawing, make sure to have a dimension sketch of the bottom of the storage tank before it is filled with oil. (Figure 1). Show on this plan every joint; it may often locate a bothersome leak. The tank bottom should rest evenly on the bed, and the tank walls should be vertical, deviations set up strains which are so increased when the tank is filled as often to cause rupture of the side or bottom plates. Cement grouting under an uneven bottom is a successful expedient. An inspector of tank construction, commenting upon an accident which occurred



in Pennsylvania, when the bottom angle iron was fractured and the tank shell was torn from the bottom, wrote as follows: "The angle iron connecting the cylinder or shell to the bottom should be laid out with great care, so that it shall lie on the bottom without rocking or buckling. The holes in the angle iron and the shell should then be drilled instead of punched, and care should be taken to have them coincide without being forced to

Figure 3



make them do so by the use of the drift-pin. When the tank is on its foundations it should have complete contact at all points. It would be difficult to construct a large tank with an absolutely flat bottom, and hence the necessity of paying careful attention to the seating in order that no part shall be left

unsupported, so as to bring an undue strain on the more rigid portions. Make a firm contact by grouting with good cement, or else secure the bottom by 'shimming' it up. The tank iron or steel should be of good quality, and the lower angle iron should be stout."

Figure 4



Figure 5

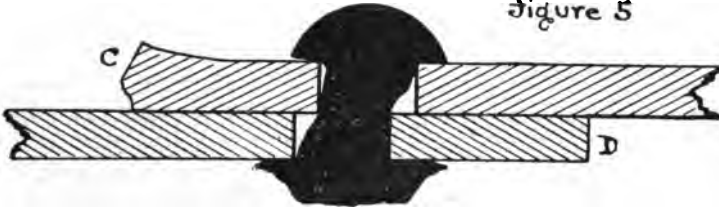


Figure 6

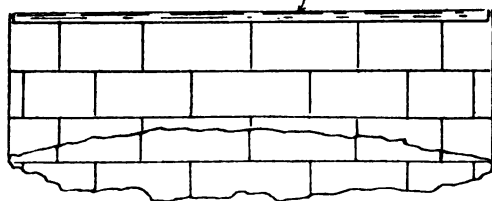


For tightness, two of the most important details of oil tank construction are the form of the rivet to be used and the manner of driving the rivets. The best rivet is one with a plug head and a swollen neck (Fig. 6). But a cup head with a swollen neck is nearly as good, and is cheaper (Fig. 4). This rivet can easily be started, but the swelled neck requires that the rivet be driven with force to bring the head up against the sheet, thus the rivet hole in one plate is well filled in a way that uses

the full strength of the rivet. There is only one good word for cold riveting—none but the best material can properly stand it. Rivets of good quality should double, when cold, without showing signs of fracture. But this rough testing has none of the advantages which follow the shrinking and shaping of a hot rivet. The heads, when hot, should stand hammering down to less than an eighth of an inch in thickness without cracking at the edge. Even a hot rivet can be so carelessly driven as to leave a leak hole; the tail should not be loosely mashed against the steel plate, but it should be upset and dressed at the same time, making a tightly set ring at the bounding line of the rivet (Fig. 4). Require hot riveting for the lower rings of the side plates of the tank; and use hot riveting elsewhere as much as can be afforded—throughout the tank, if possible. Again, the rivet holes must not be punched too far from the edge of the plate; for then, when caulked, the iron will be turned away from the other sheet if the rivets are too far back to hold the plates together stiffly. Fig. 5 shows some of the faults to be avoided.

Figure 7

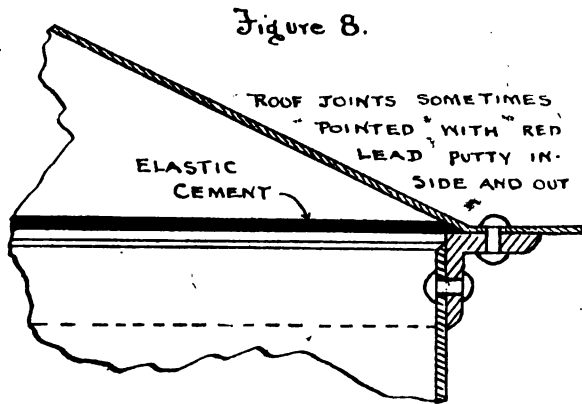
4" TO 6" WATER ROOF



When a tank is built with a flat roof it may be fitted to carry a layer of water (Fig. 7), making the roof absolutely tight against naphtha vapor. The use of the water roof was abandoned some years ago, but has recently been revived. It cannot be commended where changes in the form of the shell follow upon changes in temperature, or upon variations in the height of the contained oil; for, instead of aiding, it may detract from the strength and stiffness of the sides, and the frequent strains will soon cause the roof to leak, and the use of the water to be discontinued. In one refinery I recently noticed several tanks

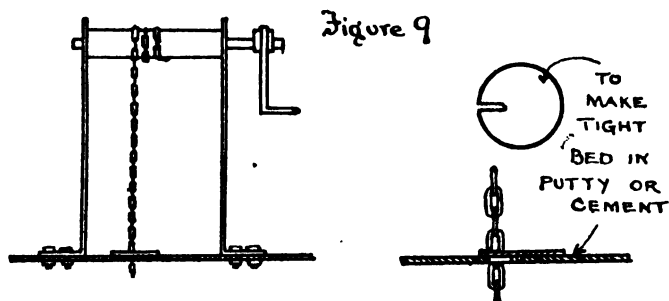
fitted with cup roofs, but in not a single instance was any water lying in the cup, even the rain water had leaked away or evaporated.

In the early specifications for the standard storage tank of the United Pipe Lines the roof was "to be conical, with a rise of 6 feet to the center, and to be covered with light iron, painted on both sides and riveted to the top angle iron. The ends of the wooden rafters supporting the roof to rest, not on the angle iron, but upon posts placed next to the shell of the tank inside." It is better to have the roof of heavier iron, the rafters of iron, and to have the roof plates and rafters securely riveted together and to the angle iron and the gusset plates around the top of the tank. Additional support may be furnished by hollow iron columns. The storage tanks in gas works are relatively small, and the desirability of having the tank, including the roof, entirely tight, is great. If out of doors, every storm on a leaking roof will cause trouble, and the value of the crude oil may be depreciated by the formation of the emulsion "B. S." Defective work may be supplemented by painting the roof joints with red lead paste and by using elastic cement on the angle iron. (Fig. 8).



No cast iron should be used ; all manholes, covers, re-enforcing plates and flanges should be made of wrought iron or steel throughout. The lower manhole should be in the plate next to the one through which the discharge pipe passes into the tank,

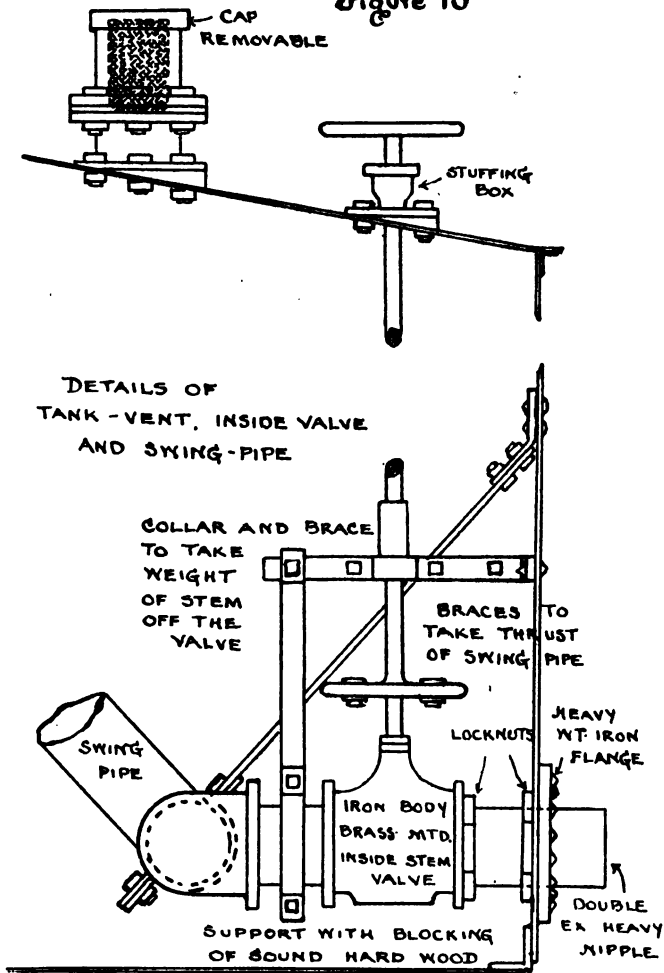
This discharge pipe should be continued through the shell by the swing pipe (Figs. 2 and 10), which is a guard against loss while filling, and controls the level from which oil or water can be drawn. This swing pipe is raised or lowered by a chain or wire rope, one end of which is secured to the pipe and the other to a windlass on the roof (Fig. 9). When rope is used it can be passed through a stuffing box, to keep the roof gas tight.



A check valve on the pipe, outside the tank, will sometimes be valuable. We so found it while unloading an oil barge in a gale; when the hawsers parted the unloading pipe broke. The oil within the storage tank was above the level of the swing pipe, but the check valve held the tank oil; while the barge pumps continued to throw oil, a thousand gallons a minute, into the bay. If a pressure gauge is placed on the discharge pipe to the tank, it may sometimes show an obstructed line—as when a valve has been left closed. To read the gauge with accuracy, while pumping, check the gauge cock until the vibrations of the arrow nearly, but not quite, cease.

When a discharge pipe is carried to the top of the tank, it should be bolted to a flange on the roof, but the pipe should not project through the roof (Fig. 2). This is found to lessen the danger of firing the tank oil by lightning, as the residue of the bolt will then not so probably cross the mixed air and gases over the oil. The valves should be brass mounted and should have indicators. There is question as to the utility of an inside valve; if the tank is high and the valve stem is vertical, the weight of the valve rod can be taken off the valve stem threads (Fig. 10). In the tank sides, below the oil line, make as few bolt holes as

Figure 10



possible (Fig. 11). If the tank bottom leaks, a cushion of water will save the oil. Of the manholes, or hatches, in the roof, one should be above the discharge pipe; if more than one, the second should be at the opposite end of the diameter, to facilitate ventilating the emptied, opened tank. When the hatches are fitted with explosion covers (Figs. 13 and 14), these are sup-

posed to be automatically closed by the falling of the covers after the escape of the gases following a violent explosion; the air being thus excluded, combustion cannot continue.

Figure 11.

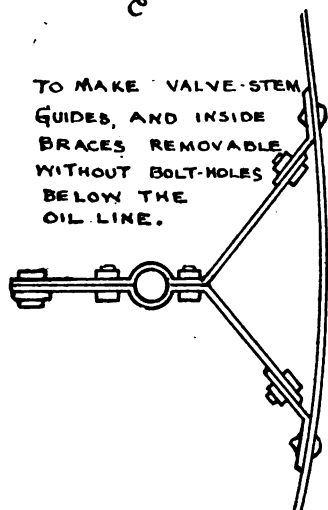
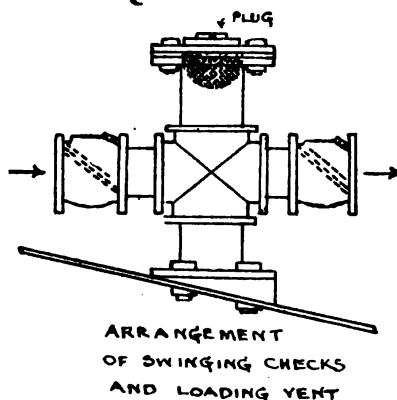


Figure 12



If the tank vent is into the open air (Figs. 10 and 12), it should be large enough to permit the easy discharge of oil into the tank at the maximum speed of delivery, with ample allowance for any accidental clogging of the wire gauge vent screen. Tanks with open vents may cause local complaints; and if the tank is exposed, there will be constant and considerable loss from evaporation; besides, there will be greater danger from damage by lightning. The ignition of an oil tank being caused by the transit of the spark across the vapor mixture, to extinguish the fire steam must be turned into the vapor space; or water may be thrown from fire nozzles the form of which spreads the streams into small sprays; these are converted into steam by the heat of the burning oil. To ward against lightning many tanks have been supplied with conductor rods, but these give little real protection. In a gas works the very safest plan to follow is to build the oil tank gas tight, and to vent it into the

Figure 13

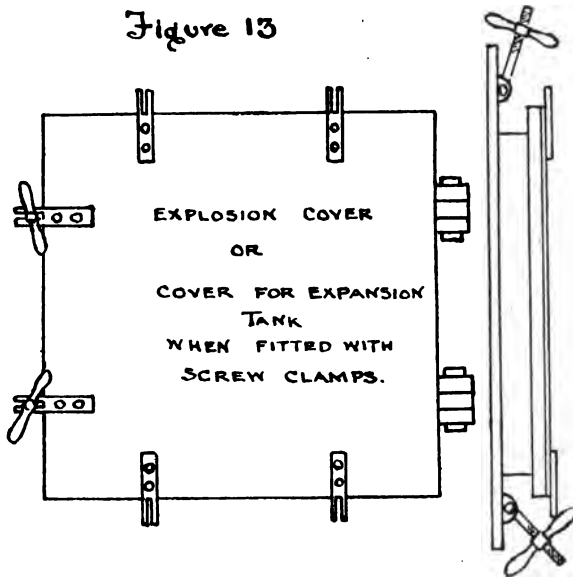
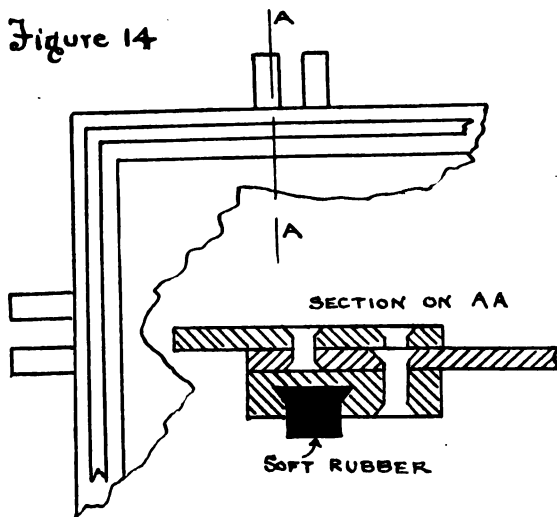


Figure 14



DETAIL OF ROOF
MANHOLE COVER
(ALL WT. IRON OR STEEL)

gas main. In this way no explosive mixture is carried in the tank, and the danger of ignition is minimized ; moreover, there is no offensive odor delivered to the atmosphere, and the vapors of the oils will either be condensed and recovered from the gas mains, or they will further enrich the gas, in neither case being lost as when discharged into the open air.

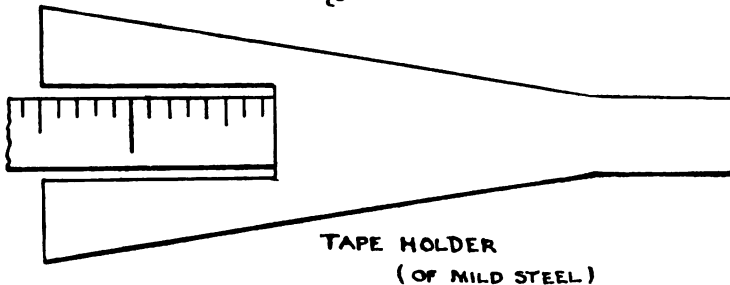
An important feature of the discharge pipe is an oil strainer (Figs. 25 and 26) ; experience can determine the suitable form and size. When using crude oils we have removed from the strainer shown in the sketch, handfuls of slimy waste, stones weighing several ounces, and once we took from the pipe a billet of bark and wood 4 feet long by 4 inches wide, much softened by time and travel, but still unable to accommodate itself to a 6 inch double elbow. An oil strainer should have a small valve for drawing water from the bottom ; for this and for similar places a good form of lock cock is shown in Fig. 26. The key can only be fitted to the head when the top of the valve is in line with the corresponding slot through the cap ; the removal of the twin key leaves the valve closed and locked.

The bottom of the tank should be thoroughly painted before lowering it to place, the outer sides and roof, being always accessible, are more easily cared for. Within the tank the enricher oil and gases will retard the deterioration of the iron. The following concise statement, by a naval constructor, respecting the care of steel vessels, is applicable to the present case. "Suppose the bottom to be grouted with cements, while the sides, top, angle-irons, brackets and rivets are painted with red lead. If cement is laid upon damp steel it will simply harden to conceal an ever-wet and corroding space, until it disintegrates or scales off to show its mischief. If red lead is applied to damp steel it dries into a smooth deceptive curtain, behind which there forms a fine rust, only to be discovered by tearing away the paint like paper from a damp wall. On the other hand, cement on a clean, dry surface of steel will remain intact for years, and a coat of good red lead upon a similar surface cannot be removed without hacking the steel itself. It is, then, imperative that a tank shall not only be thoroughly clean but thoroughly dry when cemented or painted. Now a tank in use, owing to differences of temperature between the air outside and

the oil inside, is often in a sweat of condensation, or is, at least, sufficiently damp to prevent the adhesion of paint. Tanks may be painted, year after year, only to find the same cloak of evil at the end of each year. If, then, any part of the first protective coat has been put on during a damp day when the tank is building, or if any part has not been painted at all until after the tank is in use, the mistake can never be fully remedied so long as the tank remains in use."

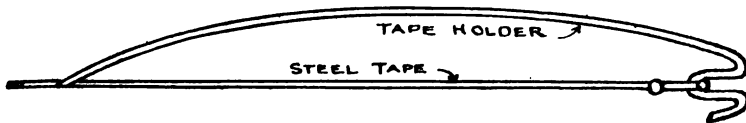
The Standard Oil Company paint their tanks with, first, standard red paint, second, standard white paint, as many coats applied as may be needed. When the storage tank is large and is exposed to the sun, the effect of the white paint is very noticeable. In the case of one large tank, when painted white, we found the loss, during September, by evaporation, was 40 gallons per diem, in the following year, during September, the tank being painted red, lost 90 gallons per diem.

Figure 15



The storage tank being built, it must be gauged. For this purpose and in general, for precise measurements only a steel tape should be used. In holding the tape to the surface of the shell, the metal tape-holder (Figs. 15 and 16) will allow the assistant to pull the tape taut. Opposite to the sheets of a gas-

Figure 16



holder, the rings of the oil tank are numbered from the bottom up. Each ring should be measured at the middle line of its height, the iron gauged, and the net inside diameter thus computed. In the most careful measurements, the deviation from the circular form where the plates lap is considered, the time, the weather, the temperature and the height of the contained oils should be recorded (Fig. 3). A deduction from capacity must be made in allowing for internal space taken up by dead-wood. In large, flat-roofed tanks, the interior looks like a young forest; the upright wooden posts (to be counted by the score) having more cross bracing than a many branched tree. In smaller tanks, the lesser loss of capacity is more quickly computed, but it should not be wholly neglected. In making up the table of capacity, each sheet of the tank should be indicated by *underlining*.

The height of the contained oils can be determined in many ways. A common method is by a float indicator, which may be so arranged as to allow no escape of gases from the tank; but this method is not so reliable as others. When the upper man-hole can be opened, a wooden gauge stick may be used; if clean, its immersion into some oils will show the surface line (and so the depth) by a clear cut mark. A modification of this method is in the use of a heavy tapered weight lowered to the tank bottom (Fig. 17); the surface of the oil is shown by a mark on the steel tape attached to the weight. To facilitate such readings the stick or tape may be coated with white or colored chalk, or with a strip of non-absorbent cloth or paper. The most exact and satisfactory measurement can be taken by lowering through the roof manhole a plumb bob, by a metal tape (Fig. 18). The tip of the bob can be touched to the surface of the oil within $\frac{1}{100}$ th of a foot. The full depth of the tank being known from measurements taken when empty, the difference of tape readings gives the height or depth of the oils contained.

On a closed tank, gauge glasses may be used. All glasses, including the topmost, should be connected to the tank at both ends of the glass, so that the vapor pressure will not cause incorrect indications (Fig. 20). A metal triangle, with a broad base, makes the oil level easily referable to a scale marked upon the tank.

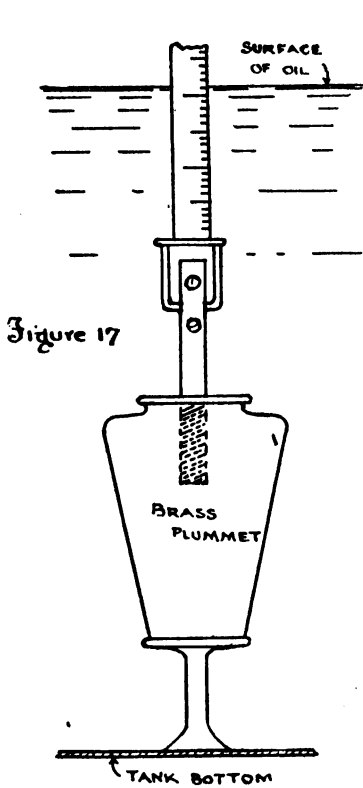


Figure 17

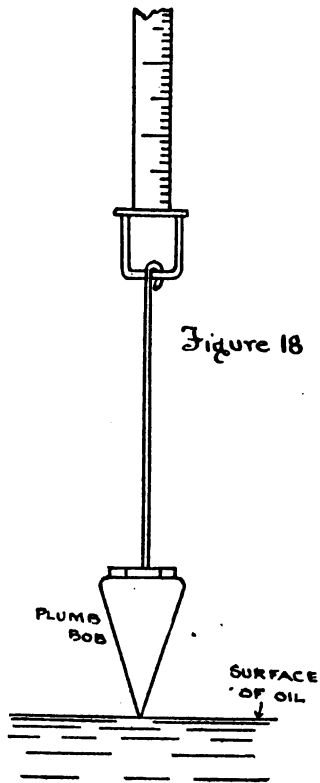
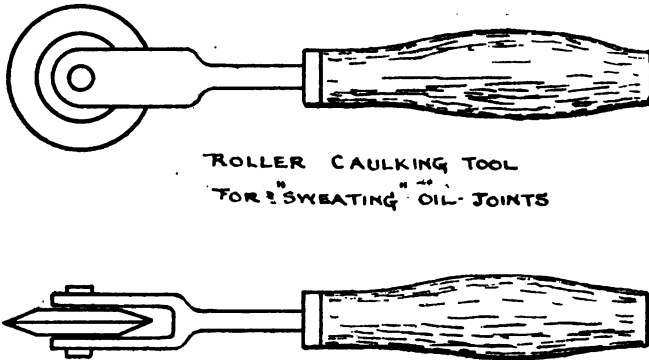


Figure 18

In measuring the oil for use in gas making, an apparently simple problem is presented. Where the oil is dipped up by revolving cups, the rate of turning easily gauges the amount used. Where oil is fed directly to the retort, under a constant liquid pressure, the oil meter may be placed in the line of piping. It is not essential that a meter measurement should agree with a tank statement, but the rate of error of a good meter must be constant. Even if the rate of error is large, if it does not change it is a good index. The meter registration, for convenience, should be in gallons. Whatever form of meter may be used, the pistons or other moving parts should not be made of rubber; it is probable that brass is the best material to employ

with the higher grades of enriching oils. The pleasant experience of some men testifies to the accuracy of oil meters; but when a meter runs within two per cent. for one month, and without 30 per cent. a few months later, confidence is displaced by doubt.

Figure 19



Some experiments with gauged valves have pointed to the possibility of using this simple device where the expense or unreliability of meters has made them unavailable. If a standard gate valve can be experimentally gauged so that under a known oil pressure, against a known resistance, a certain valve opening will mean the flow of a definite number of gallons within a specified time (Fig. 28). But with use, the spindle threads on a gate or globe valve become worn, and the flow of oil may be incorrectly indicated. The form of straight-way disc valve shown in Figures 29, 30, 31, 32 is free from this objection; and, on this valve, a graduated arc scale can be used with good results, so long as the discs remain tightly seated. Meters have been built for the measurement not only of oil but of high pressure steam! With a gauged disc valve we have much improved the control of the steam supplied to water gas apparatus.

It is very desirable that the amount of oil entering a carbureter should be exactly known. It is easier to use the meter instead of the gas maker's eye to measure the amount of oil re-

quired per run on a water gas apparatus. When the make of a single gas machine can be told off from a station meter, the oil schedule can be quickly arranged. Thus, suppose that the candle power remains constant, and that 4 gallons of oil per 1,000

Figure 20

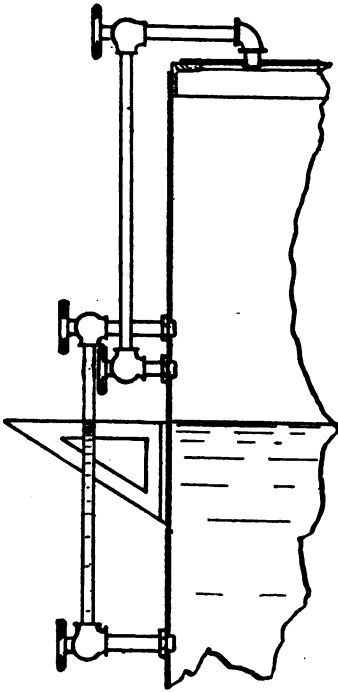
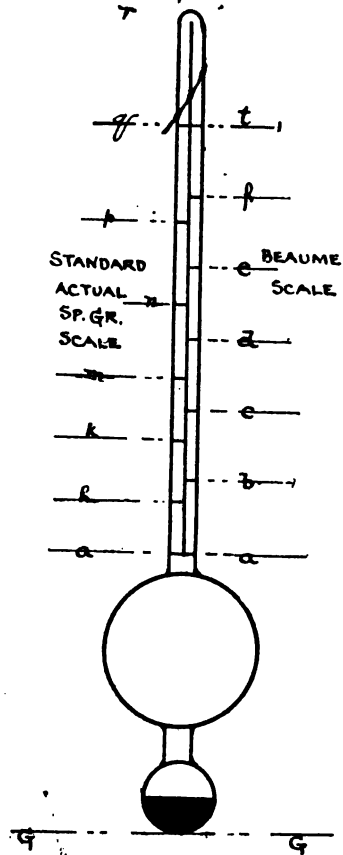


Figure 21

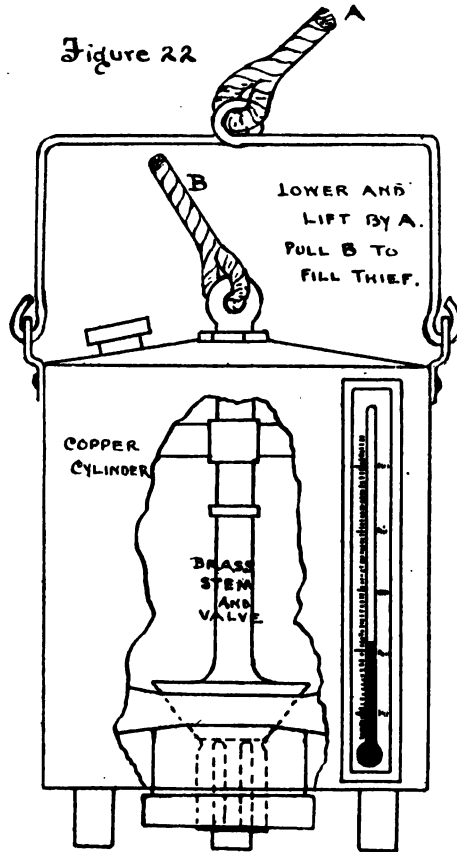


cubic feet of gas are being used ; then, if the metered make per run is as shown in Col. II., the oil to be used per run would be as shown in Col. III. :

I.	II.	III.	IV.
Run of the Cleaning.	Gas Made.	Oil Used.	Run of the Cleaning.
1st.....	12,000 cubic feet.	48 gallons.	1st
2d.....	10,000 "	40 "	2d
3d.....	9,000 "	36 "	3d
4th.....	8,000 "	32 "	4th
5th.....	7,000 "	28 "	5th
6th.....	11,000 "	44 "	6th
7th.....	9,000 "	36 "	7th
8th.....	8,000 "	32 "	8th
9th.....	7,000 "	28 "	9th
10th.....	6,000 "	24 "	10th
Totals.....	87,000 cubic feet.	348 gallons.	
Av. per run....	8,700 cubic feet.	34.8 gallons.	

Any gradual or other change in the condition of the apparatus, due to long service or to change of season, etc., can, when the station meter is unavailable, be accommodated by per cent. reductions in the schedule. Of course, from a single trial it cannot be deduced that a machine will uniformly make proportional amounts; but, in the above schedule, from the averages of the gas and oil it appears that if 34.8 gallons of oil were fed to every run, the candle power of the 12,000 cubic feet from the first run would be nearly half the candle power of the 6,000 cubic feet of the last run. Moreover, the variation in the heats attained would be excessive. It is then a real question as to whether the gas maker should, or should not, supplement the training of his experience by the employment of an arbitrary oil schedule.

To take samples of oil from any depth, or to search a tank for water, "oil thieves" are used. These are small cylinders of metal or of glass, with valves at the base, by which the oil or water is admitted and retained. Control of the apparatus is given by separate lines attached to the valve stem and to the casing; an attached thermometer gives the temperature of the sample. In one of the two forms shown (Fig. 22) the thief is closed until opened for taking the sample; in the other form



(Figs. 23 and 24) the cylinder remains open until the requisite depth is reached. The last method indicates the true amount of water; in the first method the raising of the valve creates a suction which may show more depth of water than really lies on the tank bottom.

In the laboratory measurement of enriching oils a sample is tested with a Beaume hydrometer. To correctly measure the density of the oil, the sample should be brought to a standard temperature (this is usually 60°F.) before the hydrometer is read. Where the temperature of the oil cannot be controlled,

Figure 23

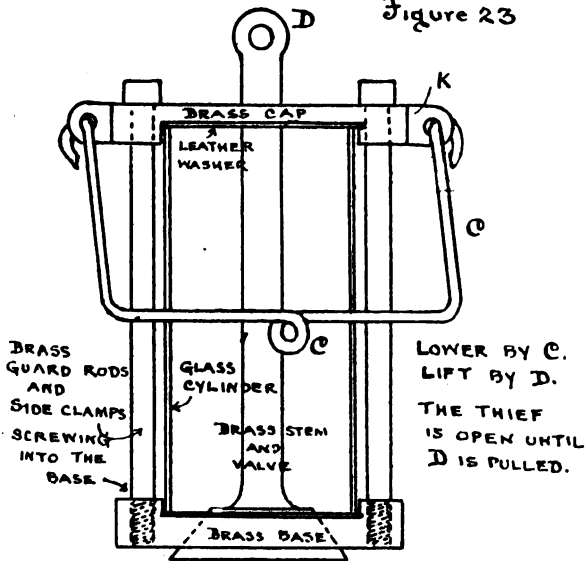
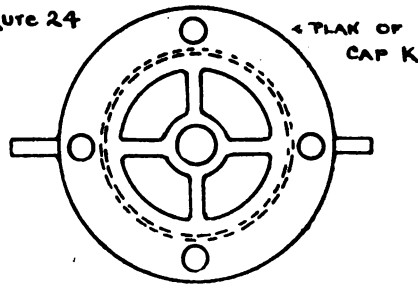


Figure 24



allowance must be made for the deviation from the standard, as the oil expands with a rise, and contracts with a fall of temperature; but not all oils change equally in bulk at the same temperature, nor does the same oil change equally in bulk for equal changes of heat at different temperatures.

On a standard absolute hydrometer, which indicates uniform changes of specific gravity, the scale divisions are not equal, but they increase in length as the hydrometer is immersed (Fig. 21). This follows from the principle in hydrostatics that when a body floats in a liquid :

Figure 25

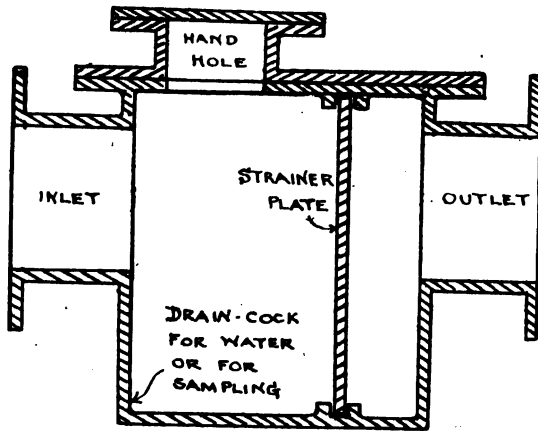
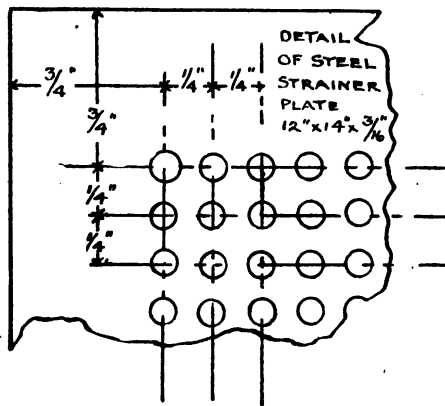


Figure 26



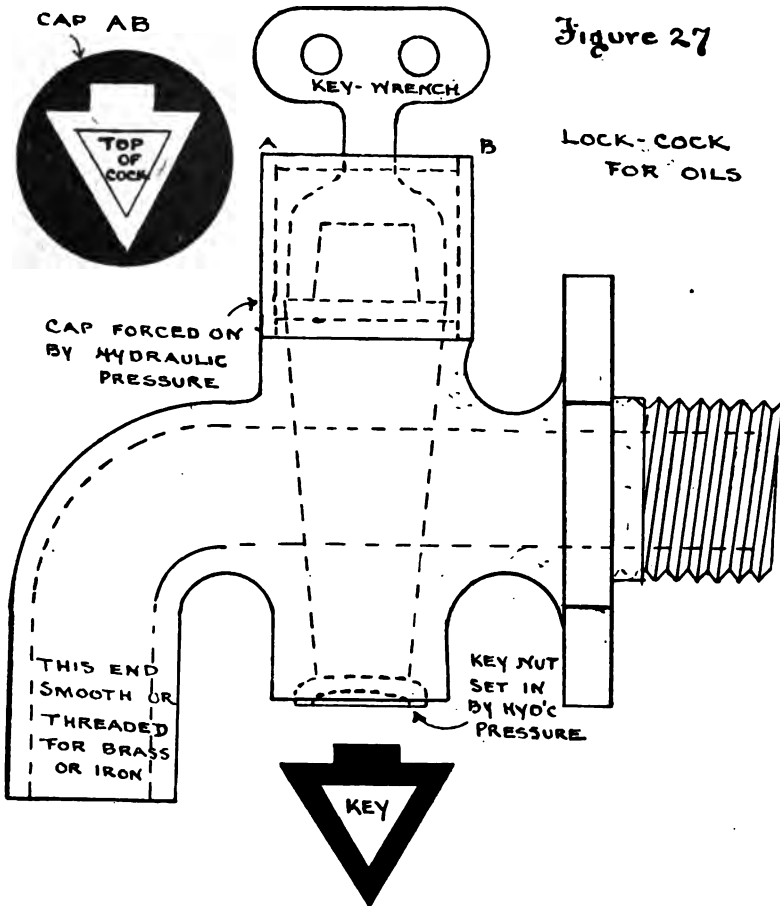
The part immersed : the whole length :: sp. gr. body : sp. gr. liquid. Then (see Fig. 21) if h denote the specific gravity of the hydrometer, and if rq, qp , etc., denote equal changes of specific gravity represented by x , the following equations result :

$$qG : rG :: h : h + a$$

$$pG : rG :: h : h + 2a$$

$$nG : rG :: h : h + 3a$$

let $h = 10a$, and let $h \times rG = s$, then



$$qG = \frac{s}{11a}; pG = \frac{s}{12a}; nG = \frac{s}{13a} \text{ etc.}$$

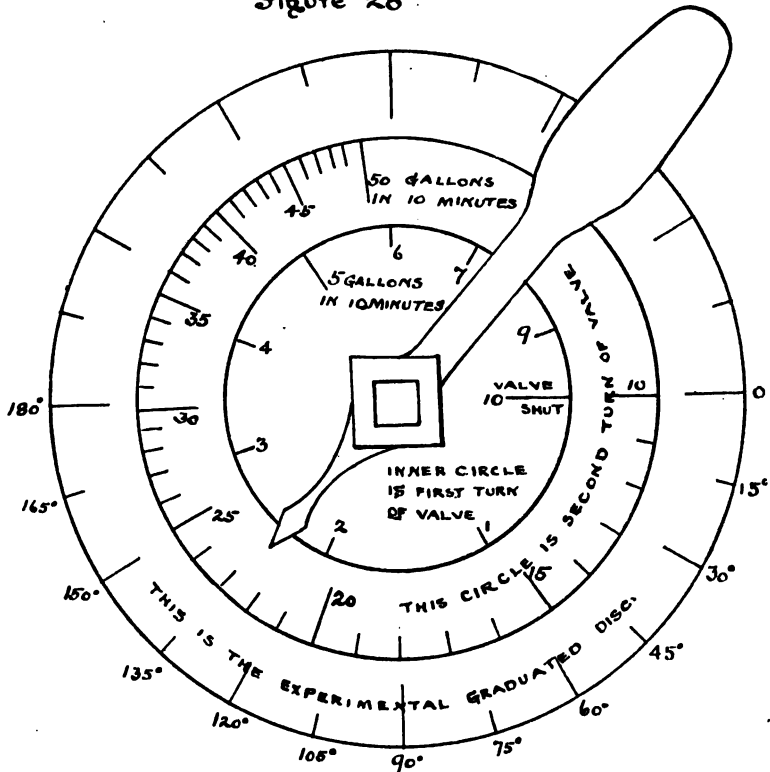
$$\text{and } qG - pG = \frac{s}{11a} - \frac{s}{12a} = \frac{s}{132} = qp$$

$$pG - nG = \frac{s}{12a} - \frac{s}{13a} = \frac{s}{156} = pn$$

therefore, qp is greater than pn , and similarly throughout the scale.

But in the Beaume hydrometer the scale divisions are equal. The graduation of the instrument differs according to its use in liquids lighter or heavier than water. For liquids heavier than water (see Fig. 21) it sinks in water nearly to the top of the

Figure 28



stem, to a point t , marked zero. The instrument is then immersed in a solution of 15 parts of salt in 85 parts of water; here it stands at the point f , which is marked 15. The distance tf is then divided into 15 equal parts, and the graduation is

Figure 29

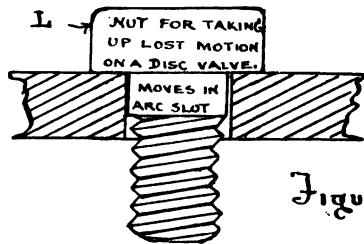
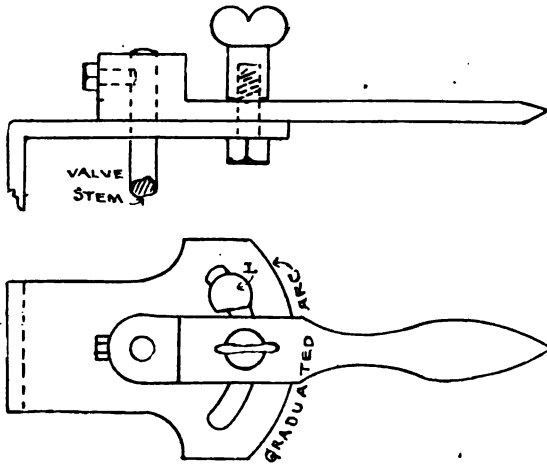
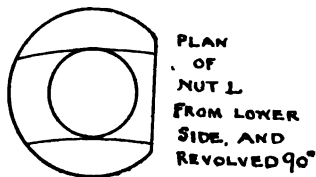


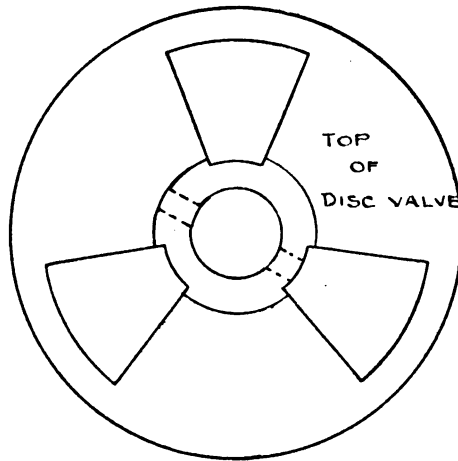
Figure 30



continued to the bottom of the stem. The external diameter of the stem is regular; the stem is hollow, and the scale may be marked on a paper inside the stem.

For liquids lighter than water, Beaume took for zero the point to which the apparatus sank in a solution of 10 parts of salt in 90 of water, and for 10° he took the level in distilled water. This distance is divided into 10° , and the division continued to the top of the stem.

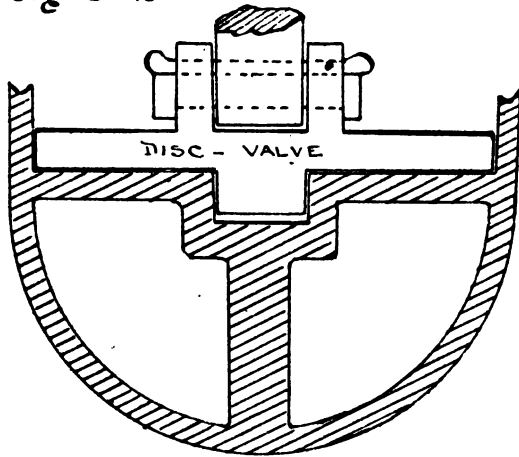
Figure 31



Here, then, we have an instrument which has two different zero points between which there is no sensible relation; and we have a scale of which each scale represents a change in density different from every other degree. That is, the change in specific gravity of 1° Beaume from 20° to 21° is not the same as the change of 1° Beaume from 80° to 81° . It is unfortunate that the scale thus devised ever came into such general use, for the only thing to commend it is its easy construction. It is said that the Beaume hydrometer is useful for making mixtures in given proportions. Suppose we mix equal portions of oils, one having a density of 10° Beaume (lighter than water) and the other having a density of 80° . What will be the specific grav-

ity of this mixture? Will it be $\frac{80 + 10}{2} = 45^\circ$? or will it be $\frac{80 - 10}{2} = 35^\circ$? As a matter of fact, it will be neither, but will be about 38° Beaume. As one result of the easy manufacture of this hydrometer, the specific gravities represented by the degrees do not always agree; the English scale, as given by Newbigging, differing from the petroleum scale prepared by the Department of the Interior of the United States.

Figure 32



Along with the beautiful simplicity of the Metric System, the French have foisted upon us a most illogical and irrational oil gauge. And in these days, when everything is standard, even to the oil itself, it is to be hoped that good fortune or good judgment will substitute a simple and sensible hydrometer in the place of this complex, arbitrary and conventional instrument.

In conclusion, in the preparation of this paper I have received special information from so many sources that I refrain from introducing the long list of the names of the persons to whom I am indebted.

Beaume (Light), U. S. Standard, in 10,000ths.

Degrees Beaume.	Specific Gravity.	Equivalent of 1° B.	Degrees Beaume.	Specific Gravity.	Equivalent of 1° B.	Degrees Beaume.	Specific Gravity.	Equivalent of 1° B.
10	1,0000		40	8235	49	70	7000	35
11	9929	71	41	8187	48	71	6965	35
12	9859	70	42	8139	48	72	6931	34
13	9790	69	43	8092	47	73	6897	34
14	9722	68	44	8045	47	74	6863	34
15	9655	67	45	8000	45	75	6829	34
16	9589	66	46	7954	46	76	6796	33
17	9523	66	47	7909	45	77	6763	33
18	9459	64	48	7865	44	78	6731	32
19	9395	64	49	7821	44	79	6698	33
20	9333	62	50	7777	44	80	6666	32
21	9271	62	51	7734	43	81	6635	31
22	9210	61	52	7692	42	82	6604	31
23	9150	60	53	7650	42	83	6573	31
24	9090	60	54	7608	42	84	6542	31
25	9032	58	55	7567	41	85	6511	31
26	8974	58	56	7526	41	86	6482	29
27	8917	57	57	7486	40	87	6452	30
28	8860	57	58	7446	40	88	6422	30
29	8805	55	59	7407	39	89	6393	29
30	8750	55	60	7368	39	90	6363	30
31	8695	55	61	7329	39	91	6335	28
32	8641	54	62	7290	39	92	6306	29
33	8588	53	63	7253	37	93	6278	28
34	8536	52	64	7216	37	94	6250	28
35	8484	52	65	7179	37	95	6222	28
36	8433	51	66	7142	37	96	6195	27
37	8383	50	67	7106	36	97	6167	28
38	8333	50	68	7070	36	98	6140	27
39	8284	49	69	7035	35	99	6114	26

NOTE BY EDITOR.

In relation to the measurement of the oil to the carburetting apparatus, the reader is reminded of a paper on the Vaporization and Feed of Oil to Generator and Retort, read by Mr. W. R. Addicks before the New England Association of Gas Engineers, Boston, February, 1890. (See American Gas Light Journal, March 17, 1890.)

DESTRUCTIVE EFFECT OF ELECTRICAL CURRENTS ON SUBTERRANEAN METAL PIPES.*

BY ISAIAH H. FARNHAM.

PAPER READ AT THE 86TH MEETING OF THE AMERICAN INSTITUTE OF
ELECTRICAL ENGINEERS, NEW YORK, APRIL 18,
AND CHICAGO, APRIL 25.

For the past year or more there have been read before water, gas and electrical engineering societies all over this country, papers on the subject of electrolytic corrosion of water pipes, gas pipes and lead cables. In fact, a meeting of such societies is incomplete to-day without some discussion on this subject. It was, therefore, with hesitation and misgivings that I considered the written invitation from the officers of the Institute to prepare a paper on the "Electrolytic effect of currents on subterranean gas and water pipes." A prominent officer of the Institute urged that, as I was undoubtedly the first to discover and satisfactorily prove that this action was destroying cables, I ought to give the society an account of my investigations and the results. On this suggestion, the promise was made to lay before you such facts as opportunity would allow. If sufficient data may be presented to form a nucleus for the evening's discussion, it will, I am sure, be of some practical value.

Early in the summer of 1891, some lead-covered telephone cable removed from wooden ducts in Boston, showed some very marked yet local spots of corrosion. The cause of the corrosion was generally attributed to acetic acid contained in the wooden conduit, which had, years before, caused corrosion on a

* For the cuts used in illustrating this article, we are indebted to "Progressive Age."

few cables in certain sections of the city. In the case just mentioned the corrosion was so severe, and located in spots only, that it led me to attribute the cause to electrolytic action from the railway currents, and a letter was written to my company to that effect.

A few months later the lead covering of a cable (No. 208) resting upon the ground in manhole chamber No. 76, located at the corner of Berkeley and Newbury streets, was found eaten entirely through at the point of contact with the earth. I then felt certain the cable had been destroyed by the action of the current. With Mr. W. I. Towne, my assistant, I proceeded to prove the theory.

We took measurements between the cable and the earth, the cable having been repaired and raised from the ground, and found 1.5 to 2 volts difference of potential, the cable being posi-

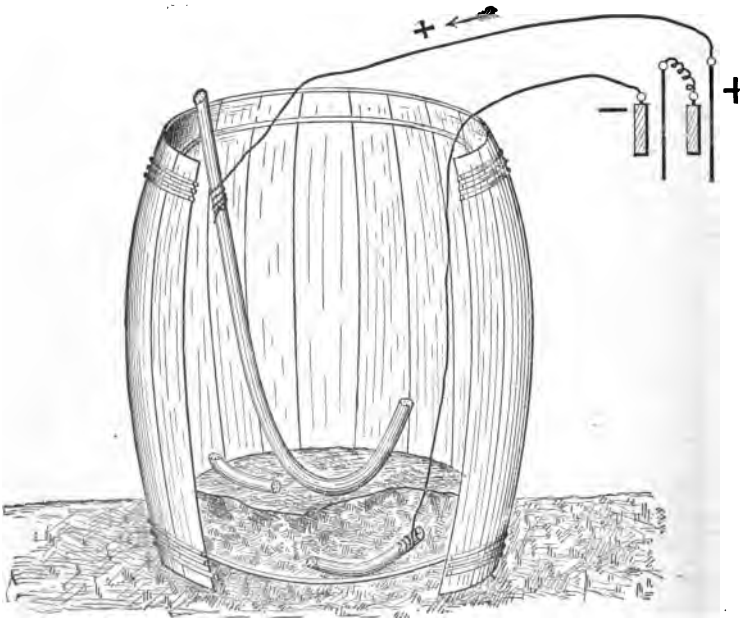


FIG. 33.

tive to the earth. A barrel of earth was procured from an excavation in the street, a metal plate placed beneath the earth in

the barrel, and two short pieces of lead cable placed side by side on top of the earth. The plate in the bottom of the barrel was then connected to the negative side of a storage battery giving 4 volts potential, and one piece of the cable lying on the earth was connected with the positive pole of the storage battery. The second piece of cable in the barrel was left without electrical connections. The earth was then saturated with water and the circuit was closed, allowing the current to pass from battery to cable, to earth, to plate and to battery, for seven consecutive days. The pieces of cable were then removed and the piece which had been connected with the battery was badly pitted, closely resembling the cable which had been destroyed, while the second piece of cable showed no corrosion whatever, proving conclusively that a current such as was found in the manhole was sufficient to cause the damage that had been found, and that the corrosion was not, in the case of the experiment at least, due to any acid or salts in the earth.

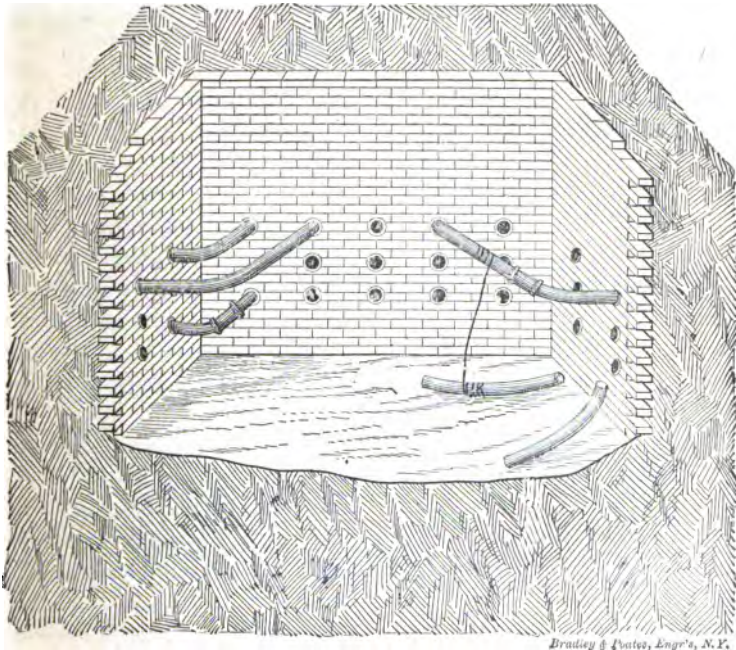


FIG. 34.

Bradley & Weston, Eng'rs, N. Y.

In addition to the experiment just mentioned, we placed in the bottom of manhole chamber No. 76, two short pieces of cable, one of which we connected by a wire to cable No. 208, which had been damaged by electrolysis. (It should be understood that the damaged cable had to be repaired, and removed from the bottom of the chamber). Fig. 34 shows the arrangement of this experiment. At the end of six weeks the pieces of cable were removed and examined. The one which had been connected with cable No. 208 was deeply pitted,* while the other piece was free from corrosion.

These experiments, with several others of minor importance, satisfied all who were interested that electrolytic action was destroying cables, and probably gas and water pipes.

It next became necessary to prove to the electrician of the railway company that the current causing electrolysis was from the railway system, and not from a leak in the Edison or some other electric lighting system.

Measurements were made between the cables in all manholes and the earth near the cables for voltage and direction of current. It was found that within a radius of about 2,000 feet from the Albany street power house, cables were negative to the earth, ranging from zero to 2 volts, and that outside of this neutral line they were positive to the earth from zero to 12 volts. This condition prevailed until a point was reached near the East Cambridge power house, when they again passed a neutral line and became more and more negative as that power house was approached. The same conditions were found as the Allston railway power house was approached. On obtaining sufficient data, maps were drawn showing voltage between cables and earth throughout all sections of the city. This is shown in map, Fig. 35.

In addition to the figures placed beside the several routes of cable conduits, showing the direction of current and its pressure, we have shaded such portion of the map where at that time we found the cables positive to the earth. We may call the shaded portion of the map the danger territory. These poten-

* The plumbers of Omaha, Neb., apply the name of "small-pox pipe" to that pitted by electrolysis.

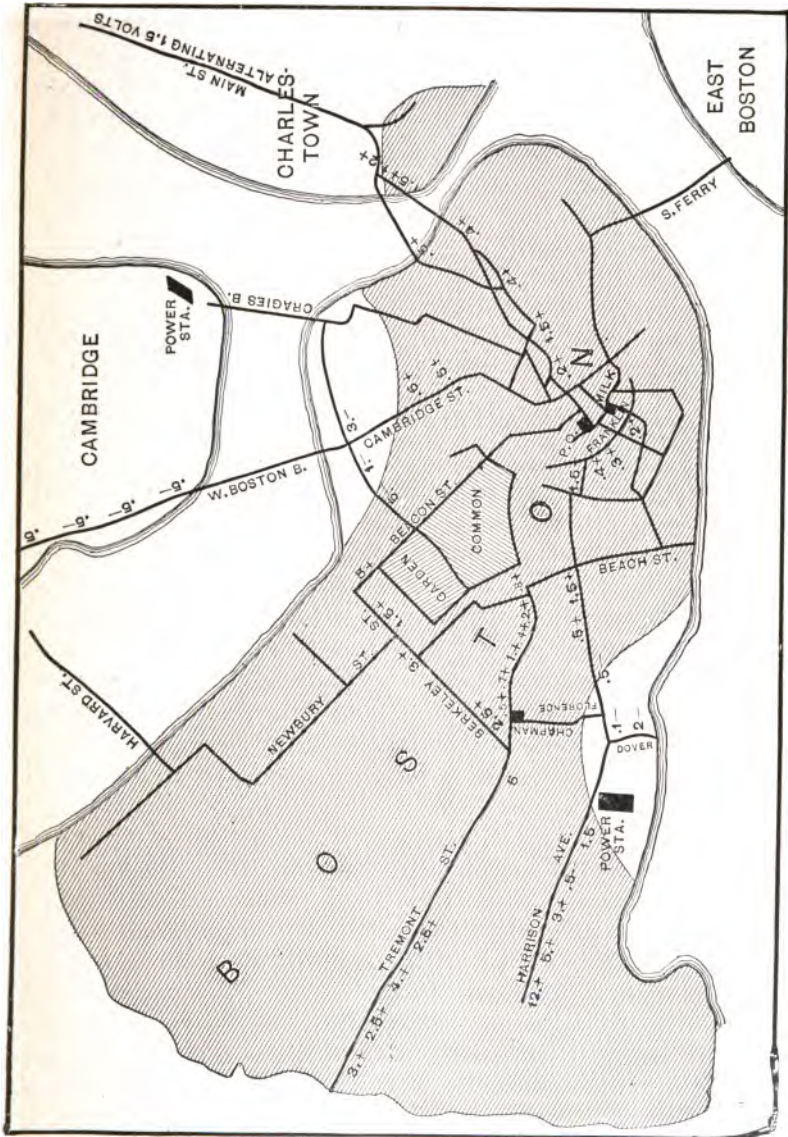


FIG. 35.

tial measurements, though taken for other purposes, incidentally furnished all the proof needed to convince one that the railway power was the source of the troublesome currents.

At the time the map was made, and previously, the railway was operating with the negative pole of the dynamo to the trolley, the positive side being to the rails.

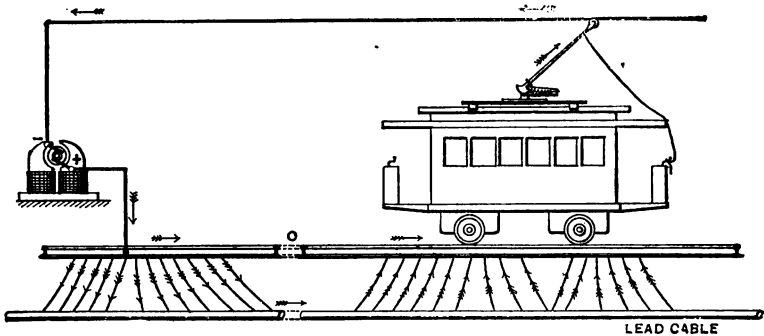


FIG. 36.

Fig. 36 is intended to illustrate this condition. It shows the passage of current from the dynamo to the rails, and the passage of a portion of the current from the rails to the cables within the neutral or zero line, and from cables to rails outside of this zero line. The danger of electrolysis is only where the current is leaving the cable or pipe through the moist earth, hence the dangerous district was at this time outside of the zero or neutral line, as shown both on the map (Fig. 35) and in Fig. 36.

Having outlined our early experience in running down this new trouble, we will next mention some of the proposed and applied remedies. Several conferences were held for the purpose of suggesting and discussing means for preventing the destruction of the cables, at which the officers and experts of both the railway and telephone companies were present, and it should be said, that the railway company in Boston has shown a disposition to adopt any promising plan for overcoming the evil, save, perhaps, the abandonment of the rails and earth as a part of the circuit.

First: It was proposed to remove all cables from the wet bottom and sides of the so-called manholes. It was found very

difficult to place and retain cables free from the wet sides, and even could this have been accomplished the action at the mouth of the ducts and within them would still have continued. They were, however, all removed from the bottom of the manholes.

Second: It was suggested that the cables might be connected to ground plates in the manholes, and so transfer the electrolytic action to these plates, and thus save the cables. This experiment was tried on an extended scale, but though many ground plates having a surface of several square feet each were connected with the cables over a large portion of the city, it was found that voltmeter readings taken between the cables and a point on the earth a short distance removed from the ground plate in any manhole, gave nearly the same pressure as before the ground plates were connected.

In some cases, the voltage between the cables and the earth was reduced 25 per cent.; in many others, no noticeable reduction was made. The ground plates were constructed from pieces of old lead cable, 6 to 10 feet in length and embedded in the wet earth at the bottom of the manholes. It was evident from this test that ordinary ground plates would not prove of material advantage for protecting the cables.

Third: Prof. Elihu Thomson suggested, among other possible remedies, the placing of motor generators at different points along the railway line, wherever the cables and pipes are found to be in danger, the motor generators to be operated by the railway power current; the secondary current developed by these generators to be utilized to lower the potential in the cables and pipes to zero, with respect to the surrounding earth or rails. The suggestion included means for automatically starting and stopping the generators, as cables might become positive or negative to the rails. The motor generators would, so to speak, pump the current out of the cables and force it into the rails whenever the potential of the former should rise above zero. Fig. 37 illustrates this suggestion. This plan has not yet been put into operation so far as I am aware.

Fourth: Insulating the cables and pipes from the earth was proposed. As some of the worst cases of corrosion of cables by electrolysis occurred where they were painted with asphalt, taped, painted again, and finally covered again with a heavy

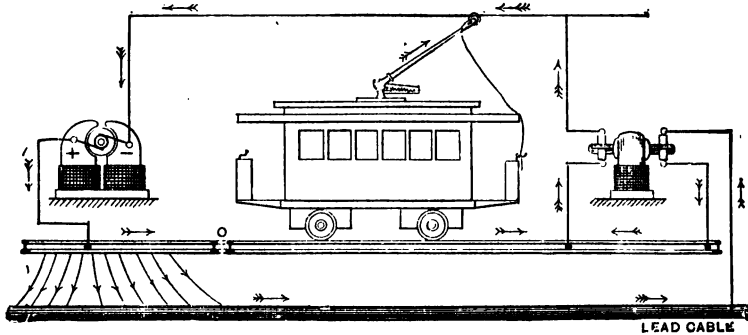


FIG. 37.

braiding also saturated with asphalt, it was apparent that to insulate cables sufficiently to protect them would be difficult and expensive, if not, indeed, practically possible. To protect water and gas pipes by a sufficient insulating jacket was seen at once to be impracticable.

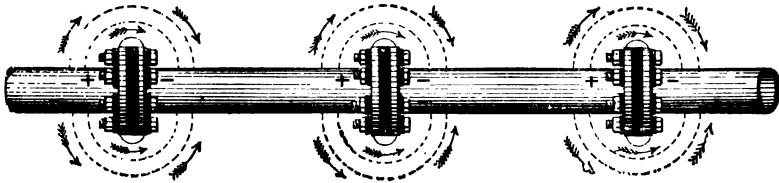


FIG. 38.

Fifth: Breaking the metallic continuity of the cable sheath and pipes was proposed. From the fact that severe action is frequently found in comparatively isolated spots, where cables and pipes cross each other or pass near or across the rails, it follows that any system of breaking the metallic continuity would have to be studied with reference to the entire complicated system of pipes, cables and rails ramifying through the streets of a city. There would also be a difference of potential between the several sections of cable or pipe, severed metallically, tending to cause electrolysis at one end of each section, as illustrated in Fig. 38. In case of water pipes, treated in this manner, the action might be expected on the interior as well as on the exterior.

There appears to be some evidence of such an action as this in gas and water pipes where the electrical continuity is partially broken by leaded joints. On an iron service pipe from the Cambridge gas system it was noticed that the action was most severe at points immediately on either side of the coupling. The reason the corrosion appeared on both sides of the coupling in this case is not clear; it may be due to reversal of current on the railway system. We have observed other specimens similar to this, which may tend to show that for currents of low pressure, the resistance of joints materially affects the results. I will again refer to this question in connection with potential differences in water mains.

Sixth: My assistant, Mr. Towne, suggested that the railway current might be so frequently alternated as possibly to prevent serious action on the pipes and cables. The theory was, that before the oxygen gas, liberated by the current, should have time to attack the metal, the reversal of the current would disperse it. A careful experiment was conducted, extending over a period of ten days, employing a pressure of current of from three to seven volts, and alternating its direction at regular periods of one minute, by specially devised apparatus. No material change had taken place in either plate during this period of time. We then considered the practicability of reversing the railway current frequently. It seemed possible to reverse it once each 24 hours, at a given time in the night when the load is comparatively light. To do this in a large system involving several power stations would require either a loss of current for a few minutes in order to guard against one station reversing before some other had opened or reversed its current, or would require some electrical system connecting the several stations together and operating the reversing apparatus simultaneously. We concluded it would be difficult, if indeed at all practicable, to reverse such heavy currents during regular traffic. We then renewed the reversing experiment, giving 24 hour periods between each alternation, but found at the end of two weeks, to our sorrow, that the plates subjected to the action of the current were seriously electrolyzed. It seemed useless to pursue this line of work further at that time. When alternating current motors become practicable for use on street cars, advan-

tage may be taken of the fact that such currents appear not to cause electrolysis to the extent of injuring pipes and cables exposed to them.

Seventh : At about this stage in the study of the problem, Mr. Fred. S. Pearson, then engineer of the West End Street Railway Co., made two suggestions, which, though separate in themselves, and presented at different dates, yet carried out in conjunction, have proved exceedingly helpful in overcoming the difficulty, at least so far as relates to telephone cables. It occurred to Mr. Pearson, first, that if the railway current should be reversed so that the positive pole would be connected with the trolley, the danger of electrolysis would be removed from the greater and more scattered portion of the city and be brought near the power stations where it possibly could be more easily dealt with. This reversal was made and the expected potential changes between cables and earth followed. Fig. 39 is a map of Boston, showing the condition after the reversal of current. The shaded or dangerous portions in this map correspond to the white or safe districts in the map, shown in the first of this paper (Fig. 35), the only variation being that, by the reversal, the neutral or zero line was thrown out a little further from the Albany street power house than it was located before. It was also noted that the cables near the power house which had been from one to two volts negative to earth before the change of current, were now one to nine volts positive to earth ; that is, they were raised higher above zero than they had been below zero prior to the reversal. Fig. 40 is a typical representation of the current flowing through the trolley, car, rails and cables at this time. It will be readily understood that with the conditions as illustrated in this figure, the electrolytic action would be confined to the territory comparatively near the power stations where the current is leaving the cables to reach the negative or rail side of the dynamo.

Mr. Pearson next suggested the plan of running out large copper conductors from the negative side of the dynamo and extending them through the dangerous district, connecting them at frequent intervals to the cables. Fig. 41 diagrammatically illustrates this plan. On the principle involved in Prof. Thomson's motor generators, this low resistance conductor connected

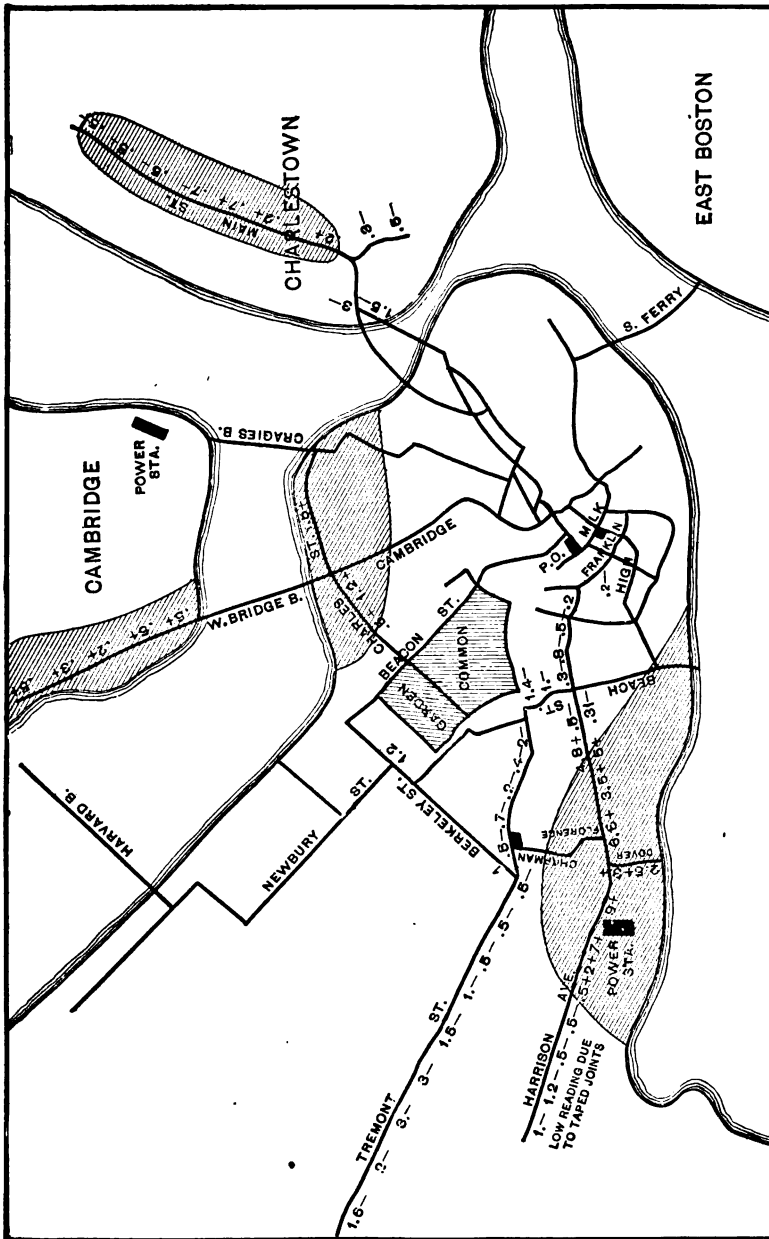


FIG. 39.

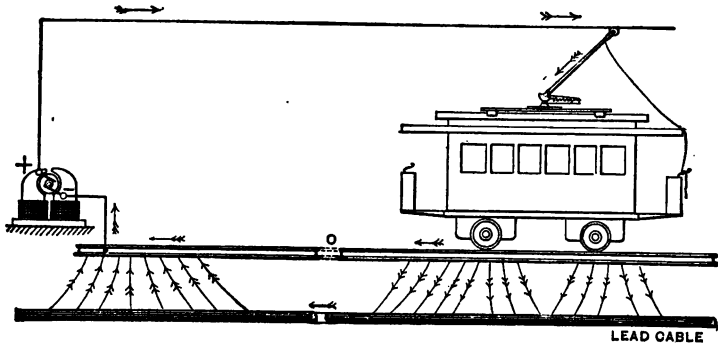


FIG. 40.

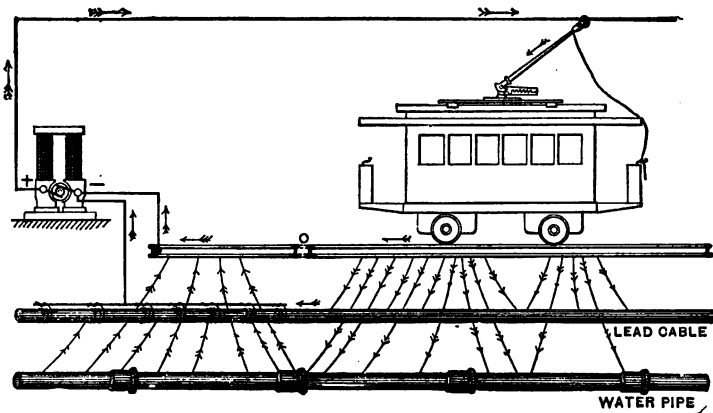


FIG. 41.

directly to the dynamo was to pump the current from the cables and so prevent its passage into or through the moist earth. Some of us were sceptical as to the completeness of this proposed remedy. It seemed possible that even with such a good return conductor some of the current might still pass into and through the earth. Voltage measurements, however, at once dispelled the doubts, for we found that the cables measuring 9 volts positive to earth gave a reading of 22 positive to the return conductor; that is, the return wire as relating to the cables was at all points more negative than the earth (if we may be allowed the expression). The return conductors were made up of a large number of No. 18 copper wires formed into cables about

one inch in diameter known as conductors of 500,000 circular mils. These conductors were extended in each direction from Albany street power house entirely through this dangerous district, its longest section being about 4,300 feet. The cables in every manhole within the district were connected by several No. 12 copper wires to the return conductor and soldered. On first connecting the cables to the return conductor, which took place Dec. 24, 1892, the current was sufficient to melt several strands of No. 12 wire. A measurement for current flowing in the main return conductor, which was used for relieving the cables only, gave about 500 amperes.

It may be interesting here to note comparative voltages in the district near the power house, as given in the accompanying table.

Manhole No.	First Measurement to Earth.	After Reversal of Railway Current.	Between Cable and Return Conductor.	Between Cables and Earth after Return Conductor was Connected to Cables.
263	1.5 +	0.3 —	22 +	4.5 —
264	1.5 +	2. +	22 +	4.5 —
265	0.5 +	0.5 +	22 +	
266	0.5 —	2.8 +	22 +	0.8 —
267		4.8 +	22 +	
268	1. —	5. +	22 +	2. —
310	1.5 —	3.5 +	22 +	1.5 —
269		4. +	22 +	
270		6.5 +	22 +	
271	2. —	6.5 +	22 +	1.5 —
272		6.5 +	22 +	0.5 —
273		9. +	22 +	1. —
274	1.5 —	9. +	22 +	2.8 —
276	0.5 +	7. +	22 +	2. —
277		2. +	22 +	
278	2. +	0.5 +	22 +	5. —
279		1. —	22 +	7.5 —
280	3. +	2. —	22 +	7.5 —
305	1. +	0.3 —	22 +	3.8 —
306	0.5 +	0.5 +	22 +	3.8 —
307	0.5 +	2.5 +	22 +	
308	0.5 —	4. +	22 +	
309	1. —	4. +	22 +	3. —
311	1. —	2.5 +	22 +	
312	2. —	2.5 +	22 +	
313		3.0 +	22 +	0.5 —
314	1. —	2.5 +	22 +	2.5 —

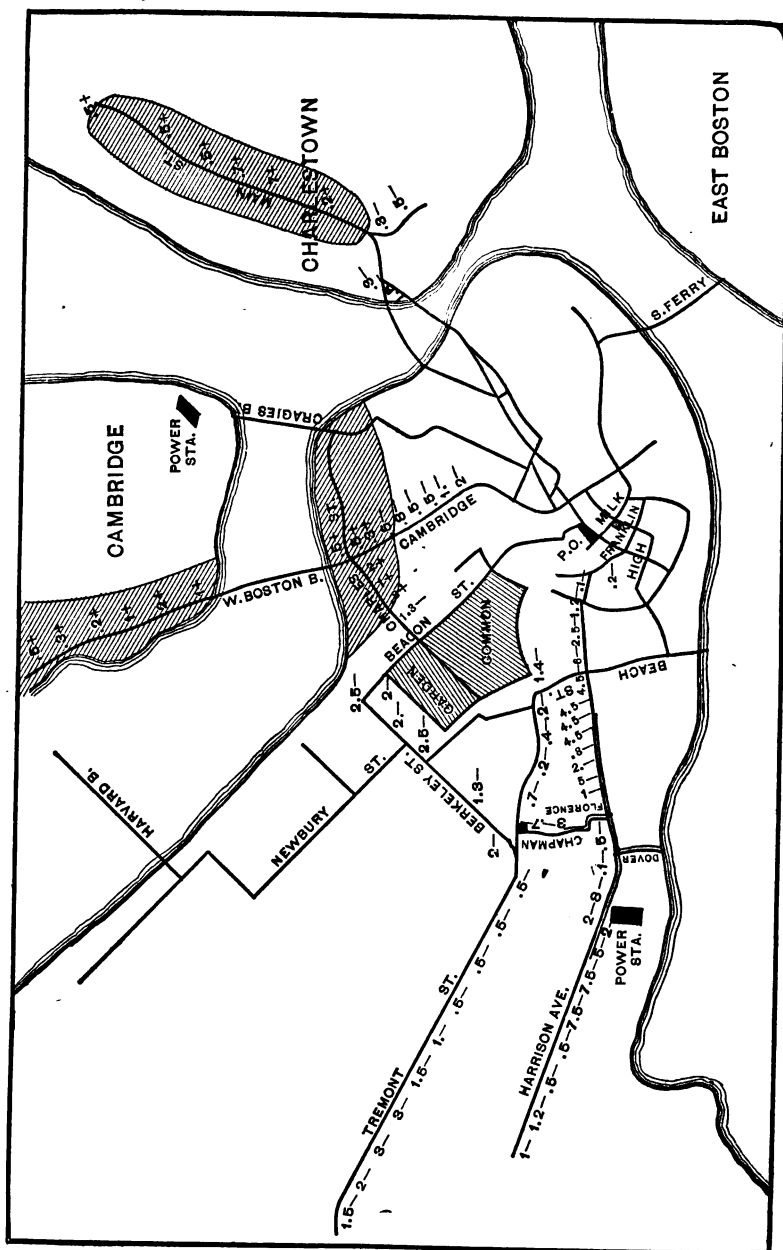


FIG. 42.

The map, Fig. 42, illustrates the condition after the installation of the return conductor at the Albany street station. The shaded patch which existed in that locality is now removed, and the cables are all negative to earth. The remaining shaded or dangerous sections were corrected by taking similar means of reaching the East Cambridge power-house. In treating this latter case, many measurements were made to determine whether or not the railway return wires put up to take the current in a measure from the tracks, would answer for a return for the cables instead of using a special return conductor as had been employed at the Albany street district. It was found that they would not answer, since the potential of these track return wires varied constantly and was frequently above that of the earth.

The cables on the Boston side of the draw of West Boston bridge proved to be positive to both the rail and the water, while on the other side of the narrow draw, the opposite condition existed, showing at once, that it was unsafe to assume any neutral lines or potential difference, without making measurements to determine the absolute facts.

So far this paper has dealt particularly with the subject of protection of lead-covered cables. It might be inferred that water and gas pipes can be treated in precisely the same manner with the same results, or as water pipes have a much greater sectional area of metal, it might be presumed that simply a connection of such pipes to the dynamo at the power station would be sufficient to bring their potential down to zero throughout the dangerous district. The facts so far coming to our notice would materially modify such inferences, and therefore should find a place here.

That iron pipes are as truly subjected to the corrosion as lead, needs not be stated to the members of this society, but for the benefit of city officials and others who may read the paper, it should be plainly stated that they are quite as readily destroyed by electrolysis.

The city engineer of Milwaukee, Mr. G. H. Benzenberg, has kindly sent me a photograph of a six-inch iron water main badly corroded. It is the best specimen of cast-iron pipe I have been able to obtain, although not the most serious case of corrosion.

Mr. Benzenberg writes that the trouble in that city was chiefly

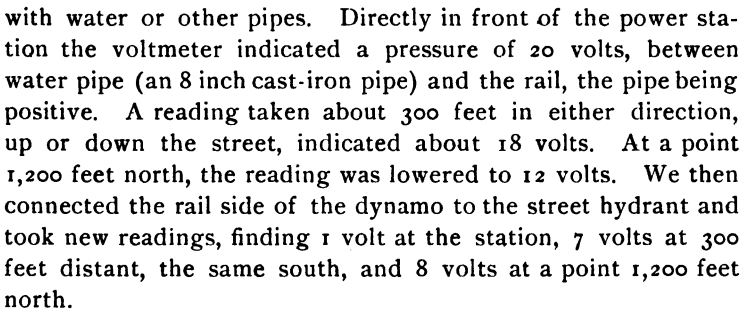
noticed upon the six-inch water main extending 100 feet on each side of a point opposite the railway power station. Services entering this main were also destroyed, and all were renewed three times during the past two years. He states further, and I quote his own words, "at other points where power houses were established thereafter, the mains were immediately connected by extra heavy copper wires with the generator ; we have had no trouble with them so far."

Mr. O. H. Tripp, engineer at Rockland, Me., recently furnished me with a specimen of wrought-iron pipe destroyed in five months ; the fact is of special interest as it comes from a city having but a small railway system.

In Boston, there have been water, as well as gas service pipes corroded through by electrolysis. I have not learned of any mains having burst from this cause. Measurements of water pipes in the city indicate they are still in danger, notwithstanding several thoroughly made connections with the pipes at the power station ; the same is true in Cambridge, Mass. This leads me to call attention to an interesting series of inquiries.

The engineer of the water board at Rochester, N. Y., suggested to me, a short time ago, while looking into the question of electrolytic action upon the pipes in that city, that possibly there might be sufficient resistance in the joints of the water mains to cause an action upon the lead ring which forms the connection between sections of pipe. He stated that not unfrequently there is found a film of moisture between the pipe and this lead ring, and as the pipes are coated with a preparation of tar or asphalt on both the inner and outer surfaces before they are laid, there might be a poor electrical connection. Without having made any inquiries or tests upon this point, it seems to me, probable, that the careful calking which is given these lead rings would form in some portion of each joint a good electrical connection ; that is, one of very low resistance. Recent measurements, however, made in Boston and others made in Albany, during the latter part of March, this year, convince me that there is a very appreciable resistance in such joints.

Fig. 43 will illustrate the conditions at Albany. We found the negative side of the dynamo to be connected with the rails, and with ground plates in old wells ; no connection had been made



h simila

These measurements, with similar indications in Boston, show plainly that there is a very appreciable resistance in the water-main joints. At the same time the measurements give fair evidence that the difference of voltage between any two sections of water pipe is very small. The interested parties at Albany have kindly consented to allow any facts or figures obtained there in reference to this subject to be placed in this paper.

MEASUREMENTS IN THE DANGER DISTRICTS.

At station.	Cable to Earth.	Positive, 12 volts.
" "	" " Rail	" 25 "
" "	Water " "	" 20 "
500 Ft. North	Cable " Earth	" 10 "
" "	" " Track	" 22 "
" "	Water " "	" 12 "
1,000 "	Cable " Earth	" 6 "
" "	" " Track	" 18 "
" "	Water " "	" 12 "
1,500 "	Cable " Earth	" 6 "
" "	" " Rail	" 18 "
" "	Water " "	" 18 "
2,000 "	Cable " Earth	" 8 "
" "	" " Rail	" 16 "
2,500 "	" " Earth	" 6 "
" "	" " Rail	" 13 "
" "	Water " "	" 8 "
3,000 "	Cable " Earth	" 4 "
" "	" " Rail	" 11 "
3,500 "	" " Earth	" 3 "
" "	" " Rail	" 12 "
" "	Water " "	" 7 "
4,000 "	Cable " Earth	" 3 "
" "	" " Rail	" 8 "
4,500 "	" " Earth	" 1 "
" "	" " Rail	" 1 "
" "	Water " "	Negative 1 "
5,000 "	Cable " "	Positive $\frac{1}{2}$ "
" "	" " "	" $\frac{1}{2}$ "

It is proposed at Albany to extend large wires (oooo) through the dangerous district, one wire for each system of pipes, connecting the pipes to them at frequent intervals.

It is probable that the remedy which has been applied to telephone cables in some cities has been the more positive from the very failure, so far, to thoroughly protect the other systems of pipes against electrolytic action. Fig. 41 (already shown) may assist to a clear understanding of this. The cables are

here shown connected by a large wire to the dynamo, while water pipes are not so treated. Therefore, the current which enters the water pipes at points outside the danger district passes to the neighborhood of the power station, and, in leaving them there, raises the potential of the earth about the cables. In other words, the current flows from the water pipes to the ground and thence to the cables in order to reach the dynamo.

Connecting any one system of pipes to the dynamo will, in a measure, protect other systems of pipes, but connecting all systems reduces the certainty or margin of certainty of protection to any one system. This will be apparent from a little study of Fig. 41 just referred to.

When all cables and pipes in the danger district are connected by sufficiently large conductors to drain them a careful adjustment in resistances in these several conductors may be found necessary in order to insure a balance between the several systems of pipes. It may lead to the necessity of reducing the carrying capacity of the conductor returning to the dynamo from the rails themselves.

The question has already arisen, and it doubtless will be repeated here, "How small a difference of potential between pipe and earth will cause electrolytic action?" In reply to this it may be stated that some of the worst cases of corrosion in Boston have occurred where the difference was but one and one-half volts. Mr. A. T. Wells, of Chicago, in describing to me an examination of some of the first cases in Cincinnati, states that the "difference of potential between the cables and the rail was never more than one-half, and usually less than one-quarter volt." Such a difference between cable and rail would mean a much less difference between cable and earth, where electrolysis takes place. Mr. John C. Lee, of Boston, has experimentally caused the corrosion on lead and iron by a difference of potential of $\frac{1}{100}$ volt.

These facts certainly indicate that but a very small pressure is necessary to produce the action and should dispel the numerous statements that well bonded rails or a large amount of rail return wires will alone overcome the trouble. In some cities, where electrolysis is in progress to-day, the return copper nearly equals that of the trolley and feed wire system. We cannot

force the current to take one path exclusively when others are open to it.

The facts given above, with others similar, though not enumerated, lead me to these conclusions :

1st. All single trolley railways employing the rails as a portion of the circuit cause electrolytic action and consequent corrosion of pipes in their immediate vicinity, unless special provision is made to prevent it.

2d. A fraction of a volt difference of potential between pipes and the damp earth surrounding them is sufficient to induce the action.

3d. Bonding of rails, or providing a metallic return conductor equal in sectional area and conductivity to the outgoing wires, is insufficient to wholly prevent damage to pipes.

4th. Insulating pipes sufficiently to prevent the trouble is impracticable.

5th. Breaking the metallic continuity of pipes at sufficiently frequent intervals is impracticable.

6th. It is advisable to connect the positive pole of the dynamo to the trolley lines.

7th. A large conductor extending from the grounded side of the dynamo, entirely through the danger territory and connected at every few hundred feet to such pipes as are in danger, will usually insure their protection.

8th. It is better to use a separate conductor for each set of pipes to be protected.

9th. Connection only at the power station, to water or gas pipes, will not insure their safety.

10th. Connection between the pipes and rail, or rail return wires, outside of the danger district, should be carefully avoided.

11th. Frequent voltage measurements between pipes and earth should be obtained, and such changes in return conductors made as the measurements indicate.

In closing this somewhat rambling paper, I can do no better than use words which will remind you of Patrick Henry ; "eternal vigilance" will be the "price" of pipes and cables where conditions favorable to electrolysis exist.

NOTE.—See Cassier's Magazine, June, 1894, for article by J. H. Vail on "Complete Metallic Circuits for Electric Railroads."—(EDITOR.)

APPENDIX TO REPORT OF WESTERN GAS ASSOCIATION COMMITTEE ON ELECTROLYSIS.

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NOTE.—At the meeting of the Western Gas Association at Cleveland, Ohio, May 16, 1894, their Committee on Electrolysis made a report (printed by each of the American gas papers in their first issues after the meeting), appended to which was this list of references to articles relating to the subject.—ED.

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- Cassier's Magazine, [Cass. Mag.] World Bldg, New York, monthly. Per annum, \$3.00; single copies, 25c.
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OBSERVATIONS ON SUNDRY METHODS OF MAKING WATER GAS FROM BITUMINOUS COAL.

WRITTEN FOR THE AMERICAN GAS LIGHT ASSOCIATION BY FREDERIC EGNER,
NORFOLK, VA.

Water Gas, in its practical form generally but little understood; its advantages not comprehended; its progress strenuously opposed by those highest in authority in the gas business twenty years ago, has made such rapid strides in professional, individual and corporate favor, the past decade, that the first condition has now completely changed; and hence the writer, in presenting this paper, is confronted with the knowledge that he cannot hope for originality with any portion of his subject. Let us trust, however, that the facts to be placed before you, may lead to such an interchange of experiences, that, as it sometimes happens, these shall be of sufficient practical value, to recompense us for the time given to the reading of this composition, and thus, in a measure, make up for its deficiencies.

The genesis of water gas, which briefly stated, consists in bringing carbonaceous material to an incandescent condition, then passing steam through the mass, thereby decomposing both; afterwards carbureting or not, the gas thus produced, has some time ago entered that stage, when the subject would no longer be interesting to an up-to-date audience of gas engineers; but in our daily practice are often developed peculiarities, the sum of the knowledge of which we define as "Experience." And proportionably, as we may be endowed with that desirable quality, which largely, though not by any means wholly, makes up the science of the gas engineer, we are enabled to overcome difficulties continually arising. But, no one may be so fortunate, or the reverse, as to have fall to his lot a complete personal acquaintance with *all* the possibilities to be encountered in the

pursuit of our professional duties ; hence we gather at these annual conventions, freely exchanging experiences, with result admitted, that the various Gas Association meetings of the past, have had a decided beneficial influence, not only upon the persons in attendance, the readers of the published proceedings, but also upon the gas and kindred industries at large. Pardon this digression, which is, in a sense, intended as my apology for having ventured to accept our Secretary's invitation to write a paper for this occasion.

In the early days of water gas one of the objections urged against it was, that bituminous coal could not be employed in its manufacture. Even retort house coke was pronounced by supposed good authorities, to be altogether unsuitable for the purpose. In those days, it happened once upon a time, that a prominent and high ranking gas engineer sent a then young gas man, incognito, to the works of the company employing the author, to learn if it was true, and if so, how we were using coke in the making of water gas, since he without trial, had declared it could not be done.

But it *was* done; and now we know that good retort house coke, weight for weight, is better than anthracite coal for that purpose, and it is only a matter of cost *which* should be used. And so it is used at a number of works, and was soon after the incident related, even at those managed by the "Doubting Thomas" referred to, who by the way, has years ago passed over "To the Silent Majority," respected and regretted by all who had the good fortune to have the honor of his acquaintance. The supposed impossibility to employ bituminous coal directly in the manufacture of water gas, naturally stimulated invention. The writer himself caught the fever, so to speak, and designed an apparatus by means of which all kinds of gas coals were quite successfully used to make water gas in a cupola generator. But in the end, at the suggestion of the president of the company—himself a gas engineer of acknowledged ability, and a past president of this Association—the coal was first converted into coke in the good old way, and the latter used in the water gas apparatus. The average results of one year, during which the writer was connected with that company, and when 88,987,000 cubic feet of 20.87 candle power water gas were

made, were as follows: Used per thousand cubic feet of gas made, 30.19 lbs. of retort house coke; 3.51 gallons of Lima crude oil, and $\frac{17}{100}$ of one gallon of 63 degree gas naphtha, and made per man, 87,585 cubic feet per day.

Heating the apparatus was done by drawing the air up through the fuel, and it was so arranged, that drawing up or down, or running steam to make gas—up or down—could be indulged in. Quite a number of patents for apparatus and process for making illuminating water gas from, or by aid of bituminous coal direct, were issued; a few of which only have survived, or ever even reached a practical test. Several methods are now in operation; and if, in the following necessarily brief description, the author shall succeed to shed additional light upon these—not too well known methods—and enable some of you to arrive at a closer conception as to what may be expected from them, he may, perhaps, after all be excused for writing this paper, and bringing the matter before you. The following which comprises the principal features of the apparatus, and the work done, is herewith respectfully submitted.

Within the past two years an advertisement could be seen in some of our technical journals, from which the following is an extract:

“The only successful process for making water gas from bituminous slack.”

“A plant in actual operation since July 28, 1892.”

“Only 3 gallons of crude oil required for carbureting, to produce 24 c. p. gas.” (How much 24 c. p. gas? F. E.)

“No condensation in pipes.”

While knowing that a portion of this claim was absolutely without foundation in fact, and willing to believe that it was made in ignorance of the truth on the part of the advertisers, though that seemed barely possible, the whole matter seemed to invite honest investigation; and hence, a little over a year ago, at date of writing, at considerable personal expense and inconvenience, the works where all this was claimed to be done, was quietly visited. The cold facts found were, that the plant was scarcely even in an experimental stage, unless it be so regarded by reason of the superintendent's trying to operate the apparatus like the old Lowe water gas machines were run, and

with anthracite, not bituminous slack, or any other kind of bituminous coal.

According to a reiterated statement of the general manager of the promoting company who had the patents to sell, 75.41 lbs. of coal and 2.99 gallons of oil were required to produce 1,000 cubic feet of gas of an undefined candle power, but say as the advertisement put it, 24 c. p. gas. How much, per man employed could be made, could not be learned. But the superintendent in charge stated, that if the gas was left over night in the small holder into which it was delivered so hot that, while gas was made, one could not bear their bare hands upon it, it would shrink 40 per cent. The results claimed were calculated before the shrinkage took place. The gas was not metered at all at the works, excepting by the lift of the small holder referred to. Such was the statement made to me, and which seemed to be borne out by what was seen on that visit.

The apparatus consisted of five cylindrical, vertical shells, from about six to four feet in diameter, as near as could be judged. These cylinders, of boiler iron lined with fire-brick, were standing in a row and at the top were connected with a horizontal, cylindrical shell, of apparently the same dimensions. There were fire doors, poke holes, steam and blast valves, distributed all over this apparatus, no doubt, where it was found to be most suitable, and on top were several hoppers through which the coal was to be charged when required. The device looked rather too complicated for good work, and such indeed the superintendent in charge said it was, and that that was one reason why he was trying to change in into a "Lowe" apparatus. Please bear in mind, however, that it is more than a year since the plant described was visited by the writer, and it may have been greatly improved during that time. Let us hope that the inventor has, or may yet, succeed in reaching that perfection with his apparatus, to which, no doubt, he honestly aspired.

But there is a lesson in all this short history, which those who are, or wish to be, interested in the gas business, would do well to ponder.

During the 21st annual meeting of this Association, those who were at Chicago may recollect the reading of an invitation

to visit the works of the "Cicero Gas Co.," where a new process, of much promise, was said to be in operation. The Columbian Exposition proved the strongest attraction for the visiting gas man, and only three members of the Association, the officers of the Cicero Gas Co. excepted, availed themselves of this opportunity. We found the works in fairly good order, though not yet complete in all its details, but through the courtesy of the superintendent of the works, the engineer of the company, and the genial inventor and adapter of the process, who was there in person to explain everything that could be desired, a fairly good insight into the practical working of the apparatus was had. The present output of the company is much less than the capacity of the works and it appeared difficult, for that reason, to obtain the exact producing power of the plant. The novel portion of the plant consisted in the gas generators, which were designed with especial view to using bituminous coals in the production of illuminating water gas.

Youghiogheny gas coal, and Du Quoin nut, which is a good variety of steam coal, have been used, also others, all with satisfactory results. As enriching material, crude oil was employed for everyday work. The duplicate apparatus at the works mentioned, occupied a floor space of 32 ft. x 45 ft., and required three men on each shift to operate it and make the gas up to inlet of purifiers. The producing capacity averages easily 400,000 cubic feet in 24 hours for the pair, although if the output warranted continuous working it is believed, and can be readily understood, that the results in every way would be better than can be now reported. The apparatus is intended to be worked in duplicate, as then it is at its best, but it is not impracticable to operate them singly. The sets, forming the duplicate apparatus, are connected below the bottom grate at the base of the generators, by means of a large valved pipe, the object of which is, that gas made in a downward run of one set may be passed upwards through the heated material in the other, thereby insuring thorough and useful decomposition of all steam, oil and tar vapors, which may not have been sufficiently acted upon in the first set. A single set consists of a vertical, cylindrical generator 7 ft. outside and 4 ft. inside diameter and 11 ft. 6 in. high, one inclined chamber or internally fired retort 22 ft. long,

7 ft. diameter and one fixing chamber 7 ft. diameter and 30 ft. high. The retort is "D" shape inside, and 30 in. x 54 in. in section. It has two fire boxes with independent though internal grates forming part of it.

The lower end is joined to the generator and the upper one to the fixing chamber. Coal fed in at the upper end is gradually coked and reaches the generator as coke. Air blast pipes are connected to bottom of generator, fire boxes of retort and fixing chamber. The course of products of combustion and gas is downward through the fixing chamber, and is assisted in the first instance by both a blower and exhauster, and when gas is made, by an exhauster only. Having seen the process in full operation, we cannot doubt that by means of this apparatus bituminous coal can be utilized direct in the production of illuminating water gas, with entire satisfaction. The results of several special tests made were reported to be as follows :

Using Youghiogheny coal, 4.31 gallons of oil and 36 pounds of said coal produced 1,000 cubic feet of 26 candle power gas. The same quality and quantity of gas required 4.66 gallons of oil and 48 pounds of coal, when Du Quoin nut was used. Gas making runs average 8 minutes ; blowing up or heating, 6 to 8 minutes. The fires are cleaned once in twelve hours. Fuel used under boilers, to make steam, is not included in that reported, but it is assumed that about as much would be required for that purpose as with the ordinary anthracite water gas generators.

The method adopted for making water gas, by one of the larger companies near New York City, is well worth considering, for although anthracite coal or coke can be used with very good results, it is, at the same time, one of the successful methods for employing soft coal direct, in making water gas.

Neither can the process be regarded in the light of an experiment any longer, for not less than 600,000,000 cubic feet of non-carbureted gas has been made in the manner about to be described, at these works since they were first started, and a very efficient coal gas plant owned by the company, has been "Let down," the water gas plant furnishing all the gas required at this date. The first two sets of this apparatus were put at work early in November, 1891, and within two years six sets

have been added to the original two. The conclusion must be that the company is satisfied with the process. These "Sets" consist each of a water gas generator, hydraulic seal and a multi-tubular condenser, which by means of the heat recovered from the passing gas furnishes from fifty to seventy-five per cent. of the steam used at the works. Besides these primary condensers, there are the usual scrubbers and condensers in another building, the same as in any ordinary gas works. In this process no air blast is employed. Instead of that the heating up is accomplished by drawing air down through the fuel in the generators, which are supplied with a fire-brick grate.

During the process of heating up, the generators are open at the top, and when making gas these openings are, of course, closed. The "Runs" are made in about the same time as in the well known "Lowe" process.

But no one who has not been there to see for himself, can appreciate the quietness of the whole operation. There is no whizz and bang, flame and smoke as in most of the cupola water gas apparatus. Unless looking on, one would not know that gas was being made ; or in other words, that the apparatus was in operation at all. The ground space occupied by a set is 14 ft. 3 in. x 9 ft. The dimensions of the generators are 9 ft. outside and 6 ft. 8 in. inside diameter, and 16 ft. extreme height. The maximum capacity of one of these generators is said to be 400,000 cubic feet daily, but the average daily production has been found to be easily 300,000 cubic feet, with the kind of material now used, viz.: "Sterling" coal. This coal is not a gas coal but a superior blacksmith coal which is largely used as a steam coal. About 5 per cent. of the fuel put into the generators is taken out when cleaning same. The cleaning is done once every 24 hours. The net results are 50,000 cubic feet of uncarbureted water gas made from each ton of coal used, and 150,000 cubic feet of inferior fuel gas per ton, which latter is consumed mostly under the carbureting retorts. The carbureting of the gas made in the generators is done in this way : Oil gas is made in the well known manner, in retorts formerly used for making coal gas, and the two gases, the uncarbureted water gas and the oil gas, are mixed at the inlet of the purifiers and from there on, pursue the usual course of all illumi-

nating gas. Eight retorts are required to each generator used. Some of the retorts are still fired with coke. The coke-fired retorts carbonize 7 gallons of oil per hour, and the gas fired ones, 9 gallons per hour. Four and eight-tenths gallons of 68 to 70 degree naphtha are used per thousand cubic feet of 25 candle power gas made. Including all labor, up to inlet of purifiers, 81,500 cubic feet are made per man employed. When anthracite coal or coke is used in the generators, the producing power of same is increased about 25 per cent. The writer has seen gas made in this manner, elsewhere. It was seen in operations where steel was melted; bars, plates and rods made; and all work done, from tempering watch springs to making large circular saws, files and other tools. At the same time, gas was drawn from the holders supplying factories to heat dwelling houses, and with aid of the Auer, or Welsbach incandescent gas burner, light them too, in a very superior manner. There should be food for serious reflection in all this for such of the members of this Association as are located in manufacturing districts, as the uncarbureted article can be produced very cheaply, as you can figure for yourselves from the data given.

It would seem to the author to require no great stretch of imagination, to suppose a suitably located gas works, furnishing, during the day time, the many millions of cubic feet of good gas for fuel, which, when supplied cheap enough, would beyond doubt, not only be used by those already so fortunate as to be near such a plant, but it would attract other factories to the neighborhood; because cheap gas for fuel would cheapen manufactures of various kinds and add not a little to the comfort of mankind by effectually ridding suffering communities of the smoke nuisance, so often and so widely complained of. At night a small portion of the plant only, would suffice to easily supply the necessary illuminating medium, by means of the "Auer" or other incandescent burner, or by carbureting the gas in the ordinary manner.

There would be no need of the immense holder capacity which some have anticipated, none whatever; and the whole matter seems feasible, is practicable, and seems financially desirable for persons who are looking for a safe, profitable investment of money.

This paper would be incomplete without reliable data for comparison. Hence the everyday results with a more generally known method of making illuminating water gas are given, and a set of the "Improved Lowe Water Gas Apparatus" has been selected as the standard. These results are not quoted as the best attainable, by any means, with the apparatus named, but are such as any one may easily obtain under like conditions.

(The unprofessional auditor or reader will please note that in all the results herewith given, the cost of purification, repairs to works, maintenance of plant, distribution, and the dozen or more additional items—all of which comprise in total, the cost of gas at the consumer's burner—are not included, because these form no part of this subject at all.)

The apparatus giving the following results, consists of a generator 6 ft. outside and 4 ft. inside diameter, and 13 ft. 9 in. in extreme height; a carbureter of about the same outside dimensions, and a superheater or fixing chamber of like outside diameter and 20 ft. high, also a hydraulic seal and a scrubber and condenser. The whole apparatus is easily accommodated, including ample working room, in a space 18 ft. x 50 ft. During a certain month, when the conditions of atmosphere and earth were most agreeable for obtaining exact results, the apparatus was operated a portion of each day, and the total hours run were 363; number of runs made, 1,048; gas made per run, 4,417.74 cubic feet; gas made per hour, 12,754.27 cubic feet; made per man employed at apparatus per day, 77,163 cubic feet. To produce 1,000 cubic feet of 24-candle power gas, required 4.67 gallons of 70 degree naphtha and 52.74 lbs., all told, of coal. This included all material bought, hence, waste or shrinkage as well. Had the apparatus not been idle more than one-half of the time, naturally, better results would have been expected and made, for while standing idle the consumption of fuel in both boiler and generator continued—reduced, of course—but, nevertheless, it was wasteful.

In conclusion, permit me to say, that the comparatively recent history of water gas, and its triumph over all obstacles, once more reminds us that "Great is Truth, and it shall prevail," and again emphasizes the old, old lesson, that everything has two sides, which in turn should remind us, that though we have fre-

quently brought to our notice, illusive, impracticable, sometimes only supposed—though in reality obsolete—alleged improvements for making gas, we should not aim to be too conservative and reject everything indiscriminately which may be honestly presented for our consideration. Remember, that while it may be commendable (within reasonable limits) to be conservative, to be progressive (with judgment) is no less so, to say the least, and the record of water gas is in evidence of that, as one of the most recent blessings of this progressive age.

PUBLIC OWNERSHIP OF GAS PROPERTIES.

WRITTEN FOR THE AMERICAN GAS LIGHT ASSOCIATION,
BY WALTON CLARK, OF PHILADELPHIA, PA.

The development of the industrial socialistic idea in America, has naturally found an early expression in the advocacy of municipal, or state ownership, of the industries that generally are, and admittedly should be, operated as monopolies. Among them the more notable are railroads, telegraph lines and gas properties. These natural monopolies, because of the large investment they represent, the quasi public character of their functions, and the number of their customers and employees, appear to the conscientious socialist peculiarly fitted to form the thin end of the wedge with which he hopes to split our industrial system; while the socialistic demagogue finds in an exaggeration of their powers, privileges and immunities, and of the success attending present public ownership, a theme as certain to secure him applause as it appeals to the prejudice of his auditors.

While in general the reasons for or against public ownership of one industry apply to the discussion of the public ownership of any industry; there are enough facts peculiar to each to justify an independent analysis of the socialistic claims relative

to each. Through the courtesy of your council I am enabled to present to you some of the facts and arguments applying to the gas industry.

Two monographs advocating the affirmative of the proposition that municipalities can, with propriety and advantage, engage in the manufacture and sale of illuminating gas, have been widely quoted. They are—"The Relation of the Modern Municipality to the Gas Supply," by Edmund J. James, Ph. D. of the University of Pennsylvania; and "Municipal Ownership of Gas in the United States," by Edward W. Bemis, Ph. D., now of the Chicago University.

It is my purpose to briefly review the arguments offered by these distinguished authors in support of their position.

Preliminary to this argument Professor James advances the proposition that the burden of proof is on the opponents of public ownership. An inquiry into the nature and purpose of a municipal organization should develop the strength of this contention, if strength it have.

A municipal corporation is formed by the authority of the state, from which it received its charter, with certain duties and privileges, each as expressed in the charter. The true and necessary functions of municipal authority are few and simple of expression. They are the provision and maintenance of public improvements, *i. e.*, pavements, parks, sewers, public buildings, etc., and the exercise of the police power; the latter covering the protection of the health and peace of the community, and the property of the citizens. "Its business is to protect property and person, leaving to individuals all the liberty compatible with this protection." Municipalities are purely artificial. Being formed to aid and protect men in the legal exercise of their various talents, they should not assume any function that it is not clearly evident cannot be performed by individuals, or associations of individuals, without harm to the general interest. The assumption by a municipality of any function that can be performed by individuals, is, then, an interference with the natural order that demands a complete demonstration of public advantage for its justification; therefore, the contrary of Prof. James' proposition is true, and the burden of proof is on the advocates of public ownership.

The argument they offer in support of their proposition differs from the usual broad socialistic contention only when it touches upon points peculiar to the gas industry.

They say, (1st) Gas is a necessity. Gas manufacture and supply is of economic necessity a monopoly; and Prof. James, voicing the general sentiment of the advocates of municipal control, writes—"Public Ownership is the natural system in all cases of necessary monopolies."

2nd.—Gas distribution involves occasional disturbance of the surface of the street. The streets are the proper care of the municipality, and, therefore, any business involving their disturbance should be controlled by the municipality.

3rd.—As a large consumer of gas, in street lighting, a city has an interest in gas manufacture, that justifies it in establishing municipal works.

4th.—Public Ownership of industries tends to purity and efficiency in the management of public affairs.

5th.—Gas companies are oppressive in their charges, their product is inferior, and their function can be better and more cheaply performed by the municipality.

That the manufacture and supply of gas in any district should be a monopoly is generally admitted; and if gas were the only satisfactory source of light available for nocturnal illumination, and therefore necessary in every household, and upon every street corner within municipal limits, its supply could reasonably be called the monopoly of a necessity.

But the fact is that gas is so far from being a necessity of modern municipal life that in the oft cited city of Wheeling, where gas was sold at 75 cents per 1000 cubic feet, there were in 1891 less than 3500 premises consuming gas, in a population of 40,000. About one-half of the residences of Wheeling were then lighted from sources other than gas.

The development of the electric light, and the perfecting and cheapening of lamps and lamp oils, are a guarantee of good service, and against extortion, on the part of venders of gas, and will forever prevent gas companies from being monopolists of the supply of a satisfactory artificial illumination. That these sources of illumination are satisfactory is proved by their presence on the premises of the poor, the well-to-do and the

rich; in residences, factories and stores. It cannot, then, be held that the supplying of gas, while necessarily a monopoly, is ever the monopoly of a necessity, and that therefore the protection of the public demands that it be municipally controlled.

The common practice among American municipalities of maintaining water works, forms no precedent of value to advocates of municipal gas works. Pure water is the prime necessity to comfort, health, and even to life. There is no substitute for it. No question of choice or economy enters into the matter. Every man must have it, and the need will perish only with the race.

The best argument in favor of municipal control of water works is the necessity of protecting the source of supply from depletion and contamination. A city can legislate to this protection, where the source is within its limits, and can influence state legislation when necessary to the end, as can no private corporation. Such protection is not necessary to the maintenance of the purity, illuminating value, or supply of artificial gas.

The only point common to water and gas supply is that each is taken by the user, as wanted, from an opening upon his own premises, the openings being connected to a common store through pipes laid in the streets. And this brings us to the second argument of the advocates of municipal control.

If an industry involving the occupancy of the subsoil, or the occasional disturbance of pavements, should therefore be municipally controlled, all street railway, electric, telephone and pneumatic tube enterprises, must take their place with the gas business, in the programme of the advocates of municipal works.

That there is no paving necessity justifying the undertaking of all, or any, of these, is shown by the facts. Cities trust to contractors to lay their pavements. Their proper repair can be, and in many cases is, secured by the same system that now compels the paving contractor to the discharge of his duty. It may be confidently asserted that pavements broken by gas companies in the conduct of their business are as promptly and thoroughly repaired as are pavements broken by municipal authorities for sewer and other subsoil work. In any event, the

pavement question is so easily adjusted that it carries little weight in an argument in favor of municipal ownership of industries.

Argument 3rd is quickly answered. At this date the amount of street gas lighting is a small and diminishing quantity. Its place is being occupied by the electric light; and this is true in cities owning gas plants. The city of Wheeling has recently erected an electric plant in part for this purpose. The public lighting is too small a part of the business of gas manufacture and supply to justify a city undertaking municipal works. A municipality cannot be the manufacturer of every article it consumes.

Referring to the fourth argument of the advocates of public ownership, I cannot join Professors James and Bemis in their wholesale denunciation of American governing bodies, and their comprehensive arraignment of the men whose savings are represented by gas shares. I do, however, agree with the former, that, if corruptible men are in charge of our public affairs, a change from private to public, or from public to private, ownership, "merely changes the form" of the temptation to corruption. The one means to purity in public, as in private business, is purity in the men entrusted with its conduct. Dishonesty found its opportunity before Stevenson or Murdock was born, and cannot be deprived of it by a change to public ownership of railroad and gas properties.

If increased efficiency be the accompaniment of municipal conduct of the gas business, the fact will appear in the analyses necessary to determine the validity of the fifth claim.

This last claim of the municipal control advocates admits of examination in the light of actual experience, and may be proven valid, or overthrown, by the test of figures. Before examining the figures it will be profitable to review the arguments offered in support of their position by writers in the affirmative of the proposition that the conditions surrounding municipalities enable them to operate gas plants more economically than can private companies.

Prof. James, in his monograph above referred to, says: "There are some considerations which go far to justify the statement that the public can manufacture more cheaply than

private enterprises. In the first place, a city can usually obtain the capital at lower rates than private individuals. . . . Secondly, since the gas company must be a monopoly it is peculiarly liable to attacks from the public. . . . There is an element of risk which must be made good by higher dividends during the periods of rest."

As far as the risk in the business affects a private corporation, and not a municipality, it is within the power of the municipality to at once remove it, to its own and the corporation's advantage. Aside from the tendency of some municipalities to confiscate gas property, by reducing the selling price of gas to a non-remunerative figure, there is but one element of risk to which a private corporation is more liable than a municipality—the risk of gas competition. The electric light, the candle, the oil lamp, are as much to be feared by the municipal plant, run on the principle that it should pay its way in interest, sinking fund, etc., as by the private plant. The light and the heat agent that is to supersede gas in the future, if there be such an agent, is as sure to work out its destiny to the injury of municipal as of private investment. This being true, a municipality that insures to its gas corporation a certain and exclusive tenure removes at once the necessity of the higher rate of interest or dividend, of which Prof. James complains.

A municipality may reasonably exact from the gas company valuable concessions in return for an assured exemption from gas competition. Such an arrangement insures the maximum of advantage to both municipality and company. A number of admirable systems are in actual operation.

In continuing the analysis of this claim to greater possibility of low cost of production under municipal than under private ownership, I will assume that all public officers will be conscientious in the discharge of their duties, and will labor as efficiently in the employ of a municipality as for their own account.

Intelligence and honesty being engaged in the manufacture and distribution of gas, and the purchase of gas making apparatus and materials, for the municipality, we would have the actual labor, materials, and repairs cost as low, and quality as high, in municipal as in private works similarly circumstanced. To find the price at which the product of the works must be

sold to preserve the equities, there must be added to the cost of labor, materials, and repairs, the interest at which the city can borrow money on its gas works bonds; a depreciation charge to cover such wear and tear on the plant as cannot properly be included in the repairs account; a sinking fund, to permit the charging off of apparatus outgrown or become obsolete, and the taxes the plant would return to the city, if operated on private account. This would make the gas works simply self-supporting, and the benefit derived by the city treasury, from the existence of the municipal plant, would be only that of a consumer of gas, and directly in proportion to the number of units of volume the city consumed.

The idea of a revenue from the sale of gas by a municipality is utterly repugnant to all ideas of equity. Cheaper gas is the only possible excuse for municipal control. If profit for the reduction of taxation were the object, the minimum of injustice, actual and possible, would be done by adopting an industry the product of which is a necessity to every citizen, and is used by citizens somewhat in proportion to the individual relief from the lightening of the taxation burden. This is probably not true of any industry, and certainly not true of the gas business.

The municipal works being run, as its advocates generally assert it should be, for the purpose of cheapening gas, the gas must, in equity, be sold at its cost, including interest charges, etc.; the city paying the gas works account for all the gas used for public illumination.

The one item of *cost* left to consider, and the only one in which an advantage is claimed for city ownership, is interest on money borrowed for the erection or purchase of works.

As a borrower the city would have no advantage over a private company guaranteed against competition. Money borrowed by the city for application mainly to reducing the cost of living to gas consumers, a class of citizens, must in equity be borrowed upon a gas works bond, a lien upon the gas property and the right to operate the same, and upon this only. It is not fair to borrow upon the credit of the entire people for the benefit of a part. There is a limit to the credit of any municipality, as of any state or individual, at a given rate of interest. The limit is often unknown until reached, but what-

ever it may be, each dollar borrowed brings it one dollar nearer. The borrowing power of the whole people should be exercised only in providing funds to be expended for the benefit of the whole people—as for pavements, parks, sewers, etc. Nor should the municipality incur the risk, inseparable from any manufacturing business, for the benefit of any class of citizens, however large. Borrowing upon a gas works bond, as above, removes, in part, the element of risk of loss from failure in the business due to competition, or other cause; for in the event of failure the bond holder takes the works and franchise for the debt. Therefore, the gas works bond of the municipality must be on the same footing, and hence command the same rate of interest as the bond of a private gas company. A parallel line of reasoning demonstrates that justice demands that the gas works bear its portion of the taxation burden.

Therefore, from the conditions just assumed, conditions favorable to the claim of the advocates of municipal ownership, and which will come into existence coincident with the millenium, the conclusion is inevitable, that a municipality cannot make gas at a lower cost than can a private company. Thus is answered the only argument advanced by the Professors above mentioned in support of their claim that public ownership will tend to cheap production.

If the claim that the functions of a gas company can be better and more cheaply performed by a municipality receives any support from experience in public ownership, it should be developed from an examination of the gas undertaking of the city of Wheeling, which Prof. Bemis calls "the most conspicuous example of success in municipal ownership." The latest reports in my possession are dated 1891.

Gas sells in Wheeling for 75 cents per 1000 cubic feet. According to the books it costs 43.7 cents delivered to the consumer. The accounts make no reference to depreciation, interest or taxes, which must be included in a statement of actual cost. For this argument I accept Prof. Bemis' estimate of depreciation, 2 per cent. Taxes in Wheeling are 1.2 per cent. These charges should obviously be estimated upon the structural value of the plant. Again I accept Prof. Bemis' low estimate, \$380,000. Interest must be figured on the investment.

This has been sworn to by the superintendent, at \$800,000. The rate of interest on Wheeling bonds with the entire credit of the city as security, is from $4\frac{1}{2}$ per cent. to 6 per cent. A gas works bond would certainly command 5 per cent. These various charges amount to 45.1 cents per 1000 cubic feet, on the gas output of 115,540,000 cubic feet; and, added to the cost as shown on the books, brings the actual cost of the gas to about 14 cents per 1000 cubic feet more than Wheeling gets for it.

This estimate includes the gas used for public lighting as if sold at 75 cents per 1000 cubic foot. Crediting all the gas sold to private consumers as paid for, the cost of the gas used for public lighting is \$1.44 per 1000 cubic feet.

The direct inference is that the city of Wheeling is deceiving itself, and in the end will have to pay roundly for its present neglect of depreciation, as it is now paying, in the loss of interest and taxes, for the present luxury of a municipal works.

Wheeling's proximity to the sources of materials is in large part the cause of the apparent low cost of gas. I will not weary you with the analyses necessary to demonstrate that municipal control at Wheeling, as elsewhere in America, has not resulted in low cost or selling price of gas light, costs of materials, etc., being considered. There would be no difficulty in demonstrating the fact.

That the gas is not exceptionally good may be readily demonstrated. The auditor of the city has sworn that the illuminating power of Wheeling gas is from 16 to 18 candles. Superintendent Darrah claims about 18 candles.

There are but seven of the twenty-one private companies in the United States, supplying each 100,000,000 to 200,000,000 cubic feet of illuminating gas per annum, that sell a gas of less than 20 candle power. The average for the twenty-one companies is 22.65 candles, or about 26 per cent. better for private companies, at all comparable with Wheeling. (See Brown's Directory of Gas Companies for data.)

The above is what analysis reveals of the "most conspicuous example of success in city ownership."

I will not weary you with analyses of the accounts of other municipally controlled plants. A statement of what analysis of the Philadelphia situation reveals will suffice.

It is only by neglecting depreciation and taxes, and charging its customers 80 per cent. more per unit of light than is charged by private companies in New York, (this item amounting in 1891 to \$1,540,000) that Philadelphia was able to make a fair interest on the \$20,000,000 that had been offered for the plant and franchise. The price has this year been reduced from \$1.50 to \$1.00 per 1000 feet. A special committee of the Select Council of Philadelphia made a report dated Mar. 29, 1894, considering the effect of this reduction upon the revenues of the city. I extract from the report, as follows :

" The Director of Public Works has placed the cost of the City's gas plant at fourteen million seven hundred and twenty-six thousand seven hundred and thirty-six (\$14,726,736) dollars and three cents ; in other words, the citizens of Philadelphia have invested that sum of money in a manufacturing plant from which they have a right to expect an adequate return in dollars and cents. Even a superficial examination of the finances of the Gas Bureau will show that under present conditions a return upon this investment is almost an impossibility. Take, for instance, the year of 1892, the most successful year in the operation of the gas works.

During that year the net profit was.....	\$1,033,990 03
To which add fifty (50) cents a thousand for all gas used for public lighting	310,229 00
Making a total profit of.....	\$1,344,219 03
The total income from gas supplied to consumers was.....	3,497,917 00
By the reduction of the price from one (1) dollar and fifty (50) cents to one (1) dollar, one-third of this income is at once cut off, amounting to.....	1,165,972 51
Leaving as a total net profit	178,246 52
From this sum must be taken the interest on the value of the works as above stated, say 5 per cent.....	738,136 80
The wear and tear of the plant, 2 per cent.....	295,254 72
A total of	\$1,033,391 52
Which under any proper system of conducting a business enterprise which does not seem as yet to have entered into the management of the books of the gas bureau, would show a deficit of....	855,145 00

Your committee do not wish to be understood as using this as an argument against dollar gas. It is simply to show that under the present conditions of manufacture and distribution, one dollar gas means an increase of burdens to the tax-payers without any compensation whatever."

Wheeling and Philadelphia have been instanced because of their prominence in the arguments of the industrial socialists. As far as I am acquainted with other municipally controlled gas works, their record is no better than that of the cities cited.

A general understanding of these facts relative to present public ownership, should somewhat dull the wedge with which the conscientious socialist seeks to split our industrial system; and a few pertinent inquiries based upon them should silence, for the moment, the rantings of the socialistic demagogue.

NOTE BY THE EDITOR.—In relation to the subject of the foregoing paper will be found an article in the FORUM, November, 1889, and the following references afford much very pertinent and interesting matter :

American Gas Light Journal.			Progressive Age.			Light, Heat and Power.		
Vol.	No.	Page.	Vol.	No.	Page.	Vol.	No.	Page.
L.....	10.....	311	IV.....	2.....	17	VII.....	7.....	199-200
LII.....	9.....	281	".....	5.....	71	".....	12.....	364
".....	13.....	429	VII.....	6.....	469	".....	23.....	755
".....	14.....	471-73-74	VIII.....	6.....	121	VIII.....	April-Monthly,	
LIII.....	3.....	75	".....	7.....	130	".....	203-205-206	
".....	9.....	291	".....	8.....	158	IX.....	Sept.....	478a
".....	24.....	849	".....	10.....	212-225	X.....	I.....	—
LIV.....	2.....	40	".....	19.....	435	".....	6.....	191
".....	19.....	668	IX.....	2.....	21-24	".....	9.....	299
".....	20.....	707	X.....	3.....	39	".....	14.....	480
LV.....	20.....	707	".....	4.....	54	".....	20.....	732-734
LVI.....	2.....	40	".....	6.....	83	XI.....	10.....	329
".....	4.....	113	XI.....	5.....	70-73	".....	13.....	434
".....	5.....	148	".....	6.....	86	XIII.....	3.....	135
".....	7.....	226	".....	7.....	103	".....	4.....	183-187
LVIII.....	7.....	218	".....	8.....	131	XV.....	3.....	120-122
LIX.....	11.....	362	".....	10.....	173	".....	4.....	172
".....	12.....	398-408	".....	14.....	235-236	".....	5.....	231-235-241
".....	13.....	445	".....	15.....	249-251	".....	6.....	284-287-295
".....	22.....	758	XII.....	12.....	272	XVI.....	1.....	11
LX.....	3.....	73				".....	4.....	173-178
".....	8.....	261				".....	5.....	221
".....	15.....	518						
".....	21.....	737						
".....	25.....	901						

UNITED STATES PATENTS RELATING TO GAS.

ISSUED SINCE JANUARY 1ST, 1894.

January 2d.

- 511,848.** APPARATUS FOR TESTING GAS PIPES. Wilhelm P. Kesserling, Chicago, Ills., assignor of one-half to Henry P. Beiler, same place. Filed September 6, 1892. Serial No. 445,205.
- 511,950.** PROCESS OF AND APPARATUS FOR CARBURETING AIR. Samuel Hibes, York, Pa. Filed January 12, 1893. Serial No. 458,138.
- 512,026.** GAS-LAMP. Michael Hicks, New York, N. Y. Filed April 25, 1893. Serial No. 471,769.
- 512,056.** GAS-HEATER AND GERM-DESTROYER. Wilson L. Potter, Hartford, Conn. Filed January 9, 1893. Serial No. 457,713.
- 512,182.** GAS HEATING APPARATUS. James W. Underwood, Sheridan, Ind. Filed April 5, 1893. Serial No. 469,137.
- 512,185.** DIAPHRAGM GAS-METER. Jacob B. Wallace, Erie, Pa., assignor to Metric Metal Co., same place. Filed March 6, 1893. Serial No. 464,646.
- 512,141.** AUTOMATIC GAS-VALVE MECHANISM FOR WATER HEATERS. Joseph Winterflood, London, England. Filed January 21, 1893. Serial No. 459,203. Patented in England March 12, 1888; No. 3,785.
- 512,191.** WATER-HEATER. James T. Hanrahan, Albany, N. Y. Filed July 14, 1893. Serial No. 480,545.
- 512,222.** GAS STOVE OR HEATER. David Rogers and Thomas Jones, Pittsburgh, Pa. Filed March 15, 1893. Serial No. 466,046.

January 9th.

- 512,268.** GAS HEATING ATTACHMENT FOR SOLID-FUEL STOVES. George Bavier, New York, N. Y. Filed May 12, 1893. Serial No. 473,930.
- 512,270.** APPARATUS FOR MANUFACTURING GAS. John D. Blakeley, Toledo, Ohio, assignor to John W. Fluke, Alfred C. Neel and Frank B. Losee, same place. Filed May 7, 1892. Serial No. 432,132.
- 512,307.** CLOCK MECHANISM FOR OPERATING GAS COCK. Henry F. Lossie, Owensborough, Ky. Filed March 10, 1893. Serial No. 465,444.

- 512,315.** IGNITING DEVICE FOR GAS OR LAMP BURNERS OR OIL OR GAS STOVES. Bernard C. Olson, Chinook, Mont. Filed May 25, 1893. Serial No. 475,503.

January 16th.

- 512,708.** GAS-FORCING PLANT. Ebenezer Hill, South Norwalk, Conn. Filed October 24, 1893. Serial No. 488,988.
- 512,950.** APPARATUS FOR THE MANUFACTURE OF GAS. Paul Dvorkovitz, London, England. Filed March 31, 1893. Serial No. 466,498. Patented in England March 18, 1893; No. 7,893.
- 513,028.** OIL GAS BURNER. Isaac Wood, Minneapolis, Minn. Filed Aug. 26, 1893. Serial No. 484,112.

January 23d.

- 513,112.** GAS AND ELECTRIC COUPLING. William J. Kelly, Boston, Mass. Filed September 19, 1893. Serial No. 485,761.
- 513,289.** IGNITER FOR GAS-MOTORS. William F. Wert, New York, N. Y., assignor to Clement Gould, same place. Filed April 13, 1893. Serial No. 470,169.
- 513,300.** ELECTRIC GAS-LIGHTER. Winsor L. Brown, San Francisco, Cal. Filed June 22, 1893. Serial No. 478,501.

January 30th.

- 513,486.** GAS-ENGINE. Henry T. Dawson, Salcombe, England. Filed April 24, 1893. Serial No. 471,630.
- 513,514.** GAS-HOLDER. August Klonne, Dortmund, Germany. Filed July 25, 1893. Serial No. 481,396.
- 513,786.** GAS PRESSURE GAUGE. Charles W. Hinman, Boston, Mass. Filed June 14, 1893. Serial No. 477,555.
- 513,790.** GAS-BURNER. Solomon M. Kemp, Baltimore, Md., assignor of one-half to William T. Henderson, same place. Filed January 31, 1893. Serial No. 460,205.
- 513,945.** APPARATUS FOR UTILIZING PRODUCER GAS AS FUEL FOR CALCINING LIMESTONE. William A. Koneman, Chicago, Ill., assignor to the Chicago Heat Storage Co., same place. Filed June 23, 1892. Serial No. 437,679.
- 513,959.** GAS-MAKING APPARATUS. James E. Weaver, Pittsburg, Pa. Filed November 20, 1891. Serial No. 412,508.

February 6th.

- 514,143.** GAS-BURNER REGULATOR. Frank M. Brooks and Charles J. Wolfreys, Brooklyn, assignors by direct and mesne assignments to John L. Vosburgh, Buffalo, N. Y. Filed March 27, 1893. Serial No. 467,725.
- 514,185.** GAS-MAKING APPARATUS. Charles C. Gilmore, Indianapolis, Ind. Filed May 12, 1893. Serial No. 473,907.
- 514,211.** GAS-ENGINE. Barton H. Coffey, New York, N. Y. Filed Nov. 14, 1892. Serial No. 451,954.
- 514,218.** OIL-GAS BURNER. John M. Ferguson, Chicago, Ill. Filed Dec. 14, 1892. Serial No. 455,125.
- 514,271.** GAS-ENGINE. Henry Pokony, Philadelphia, Pa. Filed June 23d, 1892. Serial No. 437,682.
- 514,310.** FURNACE FOR NATURAL GAS. Fred. Denz, Buffalo, N. Y., assignor of one-half to Felix Denz, same place. Filed September 11, 1893. Serial No. 485,220.
- 514,359.** VAPOR GAS-ENGINE. William W. Grant, Brooklyn, N. Y. Filed June 22, 1893. Serial No. 478,486.
- 514,428.** GAS-REGULATOR FOR WATER-HEATERS. Adolph H. Schlueter, Oakland, Cal. Filed June 16, 1892. Serial No. 436,952.

February 13th.

- 514,631.** GAS-MIXER. David P. Stirk, Indianapolis, Ind. Filed March 11, 1893. Serial No. 465,576.
- 514,713.** GAS-ENGINE. Charles S. Hisey, Aurora, Ind. Filed September 17, 1892. Serial No. 446,128.

February 20th.

- 514,919.** COMBINED COOKING-RANGE AND GAS-STOVE. Reuben R. Finch and Thomas J. Hodgkins, Peekskill, N. Y., assignors to the Union Stove Works, same place. Filed July 6, 1892. Serial No. 439,103.
- 514,994.** GAS-PRODUCING FURNACE. Samuel P. Hutchinson and S. Lloyd Wiegand, Philadelphia, Pa. Filed February 20, 1893. Serial No. 462,941.
- 514,996.** GAS-MOTOR. Karl A. Jakobson, Christiania, Norway, assignor to L. A. Enger & Co., same place. Filed December 13, 1892. Serial No. 454,976.
- 515,050.** CARBURETING APPARATUS FOR GAS OR VAPOR ENGINES. George E. Hoyt, San Francisco, Cal. Filed June 13, 1893. Serial No. 477,479.

- 515,116.** GAS OR PETROLEUM MOTOR. Henry M. L. Crouan, Paris, France. Filed April 25, 1893. Serial No. 471,772.
- 515,287.** CARBURETOR. Gustave Cabrié-Gardien, Paris, France. Filed July 18, 1893. Serial No. 480,848.
- 515,295.** COMBINED STEAM AND GAS MOTOR. James G. Lightford, Indianapolis, Ind., assignor of one-half to Henry Stacey, same place. Original application filed July 31, 1891. Serial No. 398,404. Divided, and this application filed July 21, 1892. Serial No. 440,735.
- 515,297.** ELECTRIC IGNITER FOR GAS-ENGINES. Joshua Low and James Gow, Steubenville, Ohio. Filed May 13, 1893. Serial No. 474,154.

February 27th.

- 515,397.** ELECTRIC GAS-LIGHTER. John O. Dahlgren, Boston, Mass. . Filed December 30, 1893. Serial No. 495,233.
- 515,440.** CARBURETOR. John T. McCarrier, Minneapolis, Minn., assignor of five-sixths to Edward S. Austin, Amasa C. Paul and Charles G. Hawley, same place. Filed June 15, 1893. Serial No. 477,639.
- 515,500.** MEANS OF GENERATING GASES UNDER PRESSURE FOR OBTAINING MOTIVE POWER. Alfred Nobel, Paris, France. Filed July 29, 1892. Serial No. 441,611.
- 515,580.** GAS-ENGINE. Ernest Narjot, San Francisco, Cal., assignor to Henri Vayre, same place. Filed August 2, 1892. Serial No. 441,962.
- 515,569.** GAS-PRODUCER. Leon Bemelsmans, Brussels, Belgium. Filed May 1, 1893. Serial No. 472,463. Patented in Belgium, April 26, 1892; No. 99,433.
- 515,669.** GAS-BURNER. Henry A. Fry, San Francisco, Cal. Filed February 23, 1893. Serial No. 463,389.
- 515,680.** APPARATUS FOR THE MANUFACTURE OF GAS. John W. Hayes, New Brunswick, N. J. Filed July 26, 1893. Serial No. 481,566.

March 6th.

- 515,758.** AUTOMATIC GAS-BURNER. George I. Ewers, San Francisco, Cal. Filed February 16, 1893. Serial No. 462,935.
- 515,759.** LIGHTING DEVICE FOR GAS-BURNERS. George I. Ewers, San Francisco, Cal. Filed July 13, 1893. Serial No. 480,362.
- 515,770.** GAS-ENGINE. John W. Hartley and John Kerr, Kilmarnock, Scotland. Filed March 9, 1893. Serial No. 465,233.
- 515,909.** ART OF MANUFACTURING AMMONIA. Hans A. Frasch, Cleveland, Ohio. Filed April 15, 1893. Serial No. 470,417.

- 515,968.** VALVE FOR GAS-SAVING REGULATORS. Jay C. Richardson, New York, N. Y., assignor to the Union National Gas Saving Co., same place. Filed March 29, 1893. Serial No. 468,237.
- 516,107.** GAS-BURNER. Robert Pemberton, Anderson, Ind. Filed February 6, 1893. Serial No. 461,247.
- 516,153.** HEATING ATTACHMENT FOR GAS-BURNERS. Edith Copland, Washington, D. C. Filed December 30, 1893. Serial No. 495,165.
- 516,154.** AMMONIA-STILL. Abram Ellis, Columbus, Ga., assignor of one-half to William R. Brown, same place. Filed June 11, 1892. Serial No. 436,377.

March 13th.

- 516,226** APPARATUS FOR MANUFACTURING WATER-GAS. John R. Peters, Georgetown, Pa. Filed October 3, 1892. Serial No. 447,705.
- 516,328.** GOVERNOR FOR GAS-BURNERS. Alfred Hall, Buffalo, N. Y., assignor of three-fourths to John L. Vosburgh, same place. Filed September 13, 1893. Serial No. 485,379.
- 516,344.** APPARATUS FOR SIMULTANEOUSLY SCRUBBING, PURIFYING, AND CONDENSING GAS. Charles W. Blodget, New York, N. Y. Filed May 12, 1893. Serial No. 474,020.
- 516,351.** FURNACE FOR PRODUCING FUEL-GAS. John Harleman, St. George, near St. Joseph, Mo., assignor of five-eighths to Edwin H. Collins and Frank Collins, Rock Island, Ill. Filed Sept. 1, 1893. Serial No. 484,581.
- 516,573.** GAS-APPARATUS. Scott M. Mullin and Stephen C. Green, Liberty, Ind. Filed July 1, 1893. Serial No. 479,356.
- 516,609.** GAS-LAMP. Eugene Moreau, Philadelphia, Pa., and Harlan S. Miner, Gloucester City, N. J., assignors to the Welsbach Light Co., Gloucester City, N. J. Filed January 5, 1893. Serial No. 457,357.

March 20th.

- 516,798.** GAS-CONTROLLER. Ernest Brownhill, London, England, assignor to the Brownhill Company, Chicago, Ill. Filed June 24, 1893. Serial No. 478,768. Patented in England, February 10, 1891; No. 2,423.
- 516,865.** APPARATUS FOR THE MANUFACTURE OF GAS. John J. Kirkham, Terre Haute, Ind. Filed July 28, 1893. Serial No. 481,687.
- 516,904.** LIGHTING DEVICE FOR GAS-STOVES OR OTHER BURNERS. Jacob B. Wallace, Erie, Pa. Filed April 15, 1893. Serial No. 470,399.
- 516,920.** HEAT RADIATOR. Charles I. Dangler and Henry Puppel, Cleveland, Ohio, assignors to the Dangler Stove and Manufacturing Co., same place. Filed April 6, 1893. Serial No. 469,242.

March 27th.

- 517,062.** HYDROGEN-GAS MACHINE. Henry R. Pomroy, Indianapolis, Ind., assignor of one-half to Albert F. Copp, same place. Filed February 12, 1894. Serial No. 499,859.
- 517,077.** GAS-ENGINE. Russell Thayer, Philadelphia, Pa. Filed October 11, 1893. Serial No. 487,826.
- 517,202.** PROCESS OF MANUFACTURING GAS. Gustave M. Westman, Hackettstown, N. J. Filed December 5, 1892. Serial No. 454,086.
- 517,254.** GASOMETER. Walter Wood, Philadelphia, Pa. Filed August 29, 1890. Serial No. 363,416.
- 517,271.** GAS-PRODUCER. Edward J. Duff, Glasgow, Scotland. Filed April 25, 1893. Serial No. 471,771.
- 517,344.** CARBURETOR. John W. Lambert, Union City, Ind. Filed August 28, 1893. Serial No. 484,216.
- 517,368.** GAS-METER. Henry H. Sprague, Chicago, Ill. Filed December 22, 1892. Serial No. 455,999.
- 517,386.** CARBURETING GAS-LAMP. Arthur Kitson, Philadelphia, Pa. Filed July 11, 1889. Serial No. 317,198.
- 517,398.** GAS-GENERATOR. Harper F. Smith, Philadelphia, Pa., assignor of five-eighths to William F. McCully and George McGowan, same place. Filed May 5, 1892. Serial No. 431,920.
- 517,406.** REGISTER FOR GAS-METERS. Harry B. Goodwin, Bordenstown, N. J., assignor to Goodwin Meter Co., same place. Filed July 31, 1893. Serial No. 482,014.

April 3d.

- 517,541.** GAS-ENGINE VALVE-GEAR. Barton H. Coffey, New York, N. Y. Filed December 2, 1892. Serial No. 453,871.
- 517,606.** COMBINED STEAM AND GAS GENERATOR AND ENGINE. Norman Eaton, Hopedale, Mass. Filed February 1, 1893. Serial No. 460,543.
- 517,681.** PROCESS OF MAKING FUEL-GAS FROM CRUDE OIL. Charles F. A. Convert, Chicago, Ill., assignor to the Liquid Carbonic Acid Manufacturing Co., same place. Filed March 10, 1891. Serial No. 384,400.
- 517,759.** DEVICE FOR HEATING AND VENTILATING ROOMS. Columbus Mills, Gas City, Ind. Filed October 4, 1893. Serial No. 487,170.
- 517,777.** RECEPTACLE OR TANK FOR THE STORAGE OF COMPRESSED AIR, GAS, ETC. William Timmis, Pittsburg, Pa. Filed January 25, 1894. Serial No. 498,023.

- 517,821.** GAS-ENGINE. Jacques Labataille and Justin J. Graff, San Francisco, Cal. Filed June 22, 1893. Serial No. 478,491.

April 10th.

- 517,890.** GAS OR HYDROCARBON MOTOR. Willy Seck, Ober-Ursel, Germany. Filed November 10, 1892. Serial No. 451,587. Patented in Switzerland, December 22, 1891; No. 4,454. In England, December 31, 1891; No. 22,834. In France, January 21, 1892; No. 218,837. In Austria-Hungary, April 25, 1892; No. 21,764, and No. 69,503. In Belgium, May 20, 1892; No. 99,746. In Spain, May 27, 1892; No. 13,371. In Italy, October 31, 1892; No. 32,903.
- 517,910.** GAS-APPARATUS. Charles E. White, Kansas City, Mo., assignor of seven-twentieths to Richard X. DeGraw, same place. Filed August 12, 1893. Serial No. 483,004.
- 518,091.** SAFETY GAS-COCK. George W. Cini and Gustav Maiwald, San Francisco, Cal. Filed June 26, 1893. Serial No. 478,891.
- 518,114.** GAS-HOLDER AND PURIFIER. Donald McDonald, Louisville, Ky. Filed January 8, 1894. Serial No. 496,069.
- 518,148.** STATION GAS-GOVERNOR. John Hawkyard, Saddleworth, assignor to Joseph Braddock, Oldham, England. Filed March 18, 1893. Serial No. 466,664.
- 518,172.** CENTRE-VALVE. Christian Bahvet, Fort Wayne, Ind., assignor to the Western Gas Construction Co., same place. Filed April 1, 1893. Serial No. 468,636.
- 518,177.** GAS-ENGINE. John B. Carse, Chicago, Ill., assignor to Thomas Kane, same place. Filed April 26, 1893. Serial No. 471,938.
- 518,178.** GAS-ENGINE. John B. Carse, Chicago, Ill., assignor to Thomas Kane, same place. Filed April 26, 1893. Serial No. 471,939.
- 518,181.** GAS-APPARATUS. Thomas Curley, Wilmington, Del., assignor of one-half to John McIlhenny, Philadelphia, Pa. Filed November 23, 1891. Serial No. 412,739.
- 518,202.** GAS-GENERATOR. De Witte Stearns, Chicago, Ill. Filed January 11, 1893. Serial No. 458,003.

April 17th.

- 518,429.** APPARATUS FOR CAUSTICISING AMMONIA-LIQUOR. Ernest Solvay, Brussels, Belgium, assignor to the Solvay Process Co., Syracuse, N. Y. Filed December 7, 1889. Serial No. 332,924. Patented in Belgium, October 19, 1888; No. 83,661. In Germany, November 4, 1888; No. 49,500; In France, April 15, 1889; No. 197,483. In England, May 16, 1889; No. 8,169.

- 518,451.** AIR AND GAS-MIXING APPARATUS. William Hay and William M. Kearns, Kansas City, Mo., assignors of one-third to Charles H. Joy, same place. Filed July 26, 1893. Serial No. 481,565.
- 518,536.** COCK FOR GAS-BURNERS. George A. Ries, San Francisco, Cal. Filed August 8, 1893. Serial No. 486,693.

April 24th.

- 518,582.** APPARATUS FOR THE MANUFACTURE OF GAS. Robert M. Bidelman, Adrian, Mich. Filed June 9, 1892. Serial No. 436,073.
- 518,587.** APPARATUS FOR RELEASING CARBONIC-ACID GAS. Charles F. A. Convert, Chicago, Ill. Filed April 18, 1893. Serial No. 470,532.
- 518,598.** GAS-REFLECTOR. Thomas Gill, Cleckheaton, England. Filed December 11, 1893. Serial No. 493,369.
- 518,624.** APPARATUS FOR HEATING OVENS BY GAS. Johan L. W. Olsen, Copenhagen, Denmark. Filed August 17, 1893. Serial No. 483,338.
- 518,717.** IGNITER FOR GAS-ENGINES. Feodor Hirsch, Steinway, assignor to himself and Eugene M. Jerome, New York, N. Y. Filed May 1, 1893. Serial No. 472,494.
- 518,897.** HYDROCARBON INJECTOR BURNER. Franklin M. Reed, Anderson, Ind., assignor of three-fourths to Charles E. Jones, William A. Jones and William H. Ziegler, same place. Filed June 30, 1893. Serial No. 479,236.
- 518,908.** GAS-STOVE. Laura M. Stone, Rochester, N. Y. Filed August 13, 1892. Serial No. 442,959.

May 1st.

- 519,011.** HEATING-STOVE. Lewis S. N. Wright and Charles S. Bailey, Princeton, Mo. Filed December 27, 1893. Serial No. 494,857.
- 519,039.** WATER-GAS APPARATUS. Arthur G. Glasgow, London, England. Filed October 25, 1893. Serial No. 489,111.
- 519,040.** WATER-GAS APPARATUS. Arthur G. Glasgow, London, England. Filed October 25, 1893. Serial No. 486,110.
- 519,050.** WATER-HEATER FOR GAS-STOVES. Laura M. Stone, Rochester, N. Y. Filed May 31, 1893. Serial No. 476,190.
- 519,225.** PUMP FOR COMPRESSING AIR OR GASES. George E. Belliss and Alfred Morcom, Birmingham, England. Filed August 1, 1893. Serial No. 482,112. Patented in England, February 16, 1885, No. 2,123, and February 2, 1892, No. 1,992.

- 519,305.** HEATER FOR SOLDERING-IRONS. George H. Perkins, Philadelphia, Pa., assignor of one-half to the Atlantic Refining Co., same place. Filed August 26, 1893. Serial No. 484,038.

May 8th.

- 519,357.** GAS WATER-HEATER. Samuel Stewart, Newark, N. J., assignor to the Stewart Manufacturing Co., same place. Filed June 23, 1893. Serial No. 478,606.
- 519,373.** GAS-BURNING FURNACE FOR STEAM-BOILERS. George E. Belmore, San Francisco, Cal. Filed September 12, 1892. Serial No. 445,590.
- 519,481.** VALVE FOR AIR AND GAS METERS. John Shearman, New York, N. Y. Filed May 1, 1893. Serial No. 472,645.

May 15th.

- 519,749.** GAS-BURNER FOR HEATERS. Abraham T. Welch, Washington, D. C. Filed March 30, 1893. Serial No. 468,376.
- 519,845.** GAS-REGULATOR. Theodore G. Lewis, Buffalo, N. Y., assignor to the Buffalo Dental Manufacturing Co., same place. Filed February 15, 1894. Serial No. 500,204.
- 519,868.** GAS-ENGINE. Don C. Luce, Brockton, Mass., assignor of two-thirds to Harvey F. Crawford, same place. Filed April 14, 1893. Serial No. 470,319.
- 519,880.** GAS-ENGINE. Hadwen Swain, San Francisco, Cal. Filed August 22, 1893. Serial No. 483,768.
- 519,963.** GAS-HOLDER TANK. Frederick Mayer, Baltimore, Md. Filed December 30, 1893. Serial No. 495,185.

May 22d.

- 520,088.** APPARATUS FOR SEPARATING GAS FROM LIQUID BY-PRODUCTS. John A. Dixon, East Orange, N. J., assignor by mesne assignments to the Safety Car Heating and Lighting Co. of New Jersey. Filed November 22, 1893. Serial No. 491,610.
- 520,176.** STREET-BOX FOR WATER, GAS, ETC. Alexander H. Austin, Chicago, Ill. Filed May 12, 1893. Serial No. 473,981.
- 520,309.** GAS-BURNER. Gustavos Heidel, St. Louis, Mo. Filed May 13, 1893. Serial No. 474,060.

- 520,401.** PROCESS OF AND APPARATUS FOR THE MANUFACTURE OF GAS. Frank B. Johnson, Willard P. Hall, Walter Oakley and Charles F. Currey, Topeka, Kans., assignors to the Johnson Syndicate Construction Co., same place. Filed May 27, 1892. Serial No. 434,650.

May 29th.

- 520,404.** GAS-FURNACE. Gottfried Axdorfer, Hamburg, Germany, assignor of one-half to Christian Heinrich Friedrich Sars, same place. Filed Dec. 8, 1893. Serial No. 493,078.
- 520,507.** GAS-STOVE. Charles S. Upton, New York, N. Y. Filed Dec. 1, 1893. Serial No. 492,501.
- 520,521.** GAS-BURNER. Herman Eppsrecht, New York, N. Y. Filed May 22, 1893. Serial No. 475,141.
- 520,675.** CONDENSER AND DRIP FOR GAS SERVICE-PIPES. Albert H. Gindele, Jersey City, N. J. Filed Feb. 17, 1894. Serial No. 500,489.
- 520,687.** GAS-MAKING APPARATUS. William A. Koneman, Chicago, Ill. Filed June 24, 1893. Serial No. 478,685.

June 5th.

- 520,836.** AUTOMATIC GAS LIGHTING AND EXTINGUISHING APPARATUS. Nathaniel H. Shaw, Somerville, and A. B. Shaw, Medford, Mass., assignors to the New England Automatic Gas Lighting Company, Portland, Me. Filed March 2, 1891. Serial No. 383,457.

June 12th.

- 521,165.** BURNER FOR THE COMBUSTION OF GAS OR VAPOR FOR HEATING PURPOSES. Henry A. House and Henry A. House, Jr., Bridgeport, Conn., assignors of one-half to Robert Rintoul Symon, London, England. Filed July 13, 1893. Serial No. 480,420.
- 521,166.** FEED-WATER AND GAS SUPPLY REGULATOR. Henry A. House and Henry A. House, Jr., Bridgeport, Conn., assignors of one half to Robert Rintoul Symon, London, England. Filed July 13, 1893. Serial No. 480,421.
- 521,401.** PROCESS OF AND APPARATUS FOR MANUFACTURING AQUA-AMMONIA. Thomas Charlton, Denver, Col., and Kerr M. Mitchell, St. Joseph, Mo. Filed June 12, 1893. Serial No. 477,394.

521,443. GAS-ENGINE. Sylvanus D. Sheppard, Newark, N. J., assignor to the Backus Water Motor Co., same place. Filed October 26, 1893. Serial No. 489,213.

521,444. PROCESS OF AND APPARATUS FOR ANALYSING GASES. Edward A. Uehling, Birmingham, Ala., assignor of one-half to Alfred Steinbart, same place. Filed April 20, 1893. Serial No. 471,142.

June 19th.

521,479. APPARATUS FOR GENERATING GAS. Heinrich F. D. Schwahn, Kansas City, Mo. Filed September 12, 1893. Serial No. 485,371.

521,551. APPARATUS FOR STARTING GAS-ENGINES. John W. Raymond, San Francisco, Cal. Filed April 10, 1893. Serial No. 469,772.

521,561. VENTILATOR. Wiltsie F. Wolfe, Newton, Mass. Filed August 10, 1893. Serial No. 482,862.

521,664. GAS-GOVERNOR. Silas H. Moore, New York, N. Y., assignor to himself and Alfred M. Vernon, same place. Filed November 1, 1893. Serial No. 489,711.

521,675. PUMPING APPARATUS FOR GAS, AIR, WATER, ETC. George P. Schneider, Cleveland, Ohio. Filed Feb. 11, 1893. Serial No. 461,937.

521,718. MEAT-BROILER GAS-STOVE. Benjamin S. Koll, St. Louis, Mo., assignor by mesne assignments to Louis B. Jones, same place. Filed February 23, 1893. Serial No. 463,357.

521,745. GAS-METER. Frederick C. Viney, Philadelphia, Pa. Filed Dec. 18, 1893. Serial No. 493,927.

June 26th.

521,822. GAS GENERATOR AND BURNER. Clifford F. Sanford, Findlay, Ohio. Filed January 11, 1894. Serial No. 496,502.

522,054. GAS-METER. Emil Haas, Mentz, Germany. Filed November 28, 1892. Serial No. 453,369.

522,088. BURNER FOR ILLUMINATING-GAS. Charles A. Shaw, Revere, Mass. Filed January 4, 1894. Serial No. 495,670.

522,137. LID FOR GAS-RETORTS. Charles C. Walker, Donnington, near Newport, England. Filed February 20, 1894. Serial No. 500,906.

UNITED STATES PATENTS RELATING TO GAS.

EXPIRED SINCE JANUARY 1ST, 1894.

January 2d.

7,456. GAS-RETORT LID FASTENINGS. H. G. Morris, Philadelphia, Pa.,

PATENTS OMITTED FROM LIST, PAGE 88.

June 26th, 1894.

521,915. MEANS FOR LIGHTING GAS RANGES, HEATERS, ETC. Carter H. Page, Jr., Philadelphia, Pa., assignor to the United Gas Improvement Co., same place. Filed September 25, 1893; Serial No. 486,399.

521,916. APPARATUS FOR HEATING WATER. Carter H. Page, Jr., Philadelphia, Pa., assignor to the United Gas Improvement Co., same place. Filed September 25, 1893; Serial No. 486,400.

521,917. APPARATUS FOR HEATING WATER. Carter H. Page, Jr., Philadelphia, Pa., assignor to the United Gas Improvement Co., same place. Original application filed Sept 25, 1893; Serial No. 486,400. Divided, and this application filed Dec. 30, 1893; Serial No. 495,241.

186,302. GAS AND AIR CARBURETTERS. O. F. Boomer and H. R. Randall, New York, N. Y. Filed June 15, 1876.

186,343. ELECTRIC GAS-LIGHTING ATTACHMENTS. C. H. Hinds, New York, N. Y. Filed May 22, 1876.

January 23d.

7,470. GAS-BURNERS. Bernard Donohue, Yonkers, N. Y. Patent No. 157,278, dated December 1, 1874. Filed January 4, 1877 (Reissue),

- 7,474.** GAS-STOVES. Walter M. Jackson, Providence, R. I., assignor of one-half interest to H. N. Smith. Patent No. 171,814, dated January 4, 1876. Filed December 9, 1876. (Reissue).

January 30th.

- 186,672.** AUTOMATIC EXTINGUISHERS FOR GAS-BURNERS. T. T. Fryer, Buffalo, N. Y. Filed September 7, 1876.
- 186,692.** APPARATUS FOR MANUFACTURING GAS FROM PETROLEUM, &c. James Rigby, Montreal, Quebec, Canada. Filed July 28, 1876.
- 186,747.** GAS-PURIFIERS. P. Munzinger, Philadelphia, Pa., assignor to Morris, Tasker & Co. (limited), same place. Filed Oct. 10, 1876.
- 186,789.** GAS-REGULATORS. G. E. Bingham, Chicago, Ill. Filed June 17, 1876.

February 6th.

- 186,920.** GAS-BURNERS. John F. Barker, Springfield, Mass. Filed November 3, 1876.
- 187,018.** OVENS FOR GAS-STOVES. W. M. Jackson, Providence, R. I. Filed August 1, 1876.
- 187,026.** GAS-REGULATORS. E. O. Martin, Greece City, Pa. Filed November 18, 1876.
- 187,042.** GAS-GOVERNORS. P. Munzinger, Philadelphia, Pa., assignor to Morris, Tasker & Co. (limited), same place. Filed December 20, 1876.
- 187,072.** GAS-TORCHES. Albert R. Weiss, Brooklyn, N. Y. Filed January 13, 1877.
- 187,092.** GAS-ENGINES. Robert D. Bradley, Preston, Md. Filed July 11, 1876.
- 187,093.** APPARATUS FOR GENERATING MOTIVE-GAS FROM WATER. Robert D. Bradley, Preston, Md. Filed July 11, 1876.

February 13th.

- 187,403.** SELF-LIGHTING GAS-BURNERS. R. R. Moffatt, Brooklyn, N. Y., assignor of one-third his right to C. K. Brower, same place. Filed January 5, 1877.
- 187,418.** GAS-BURNERS. S. C. Salisbury, New York, N. Y., assignor of one-half his right to Joseph H. Brown, Pittsburgh, Pa. Filed July 29, 1876.

February 20th.

- 187,512.** GAS-BURNERS. Edw. Coe, New Haven, Conn., assignor to American Street Lighting Co., same place. Filed February 2, 1877.

- 187,589.** REFLECTORS. Emil Boesch, San Francisco, Cal. Filed December 19, 1876.
- 187,614.** CARBONIC-ACID-GAS GENERATOR. Wm. Gee, New York, N. Y. Filed January 17, 1877.
- 187,667.** CARBURETERS. John J. Paquette, New Orleans, La. Filed Dec. 27, 1876.
- 187,673.** EXTENSION DEVICE FOR CHANDELIERS. Jacob Roberts, New York, N. Y. Filed January 17, 1877.

February 27th.

- 187,734.** PROCESSES AND APPARATUS FOR MANUFACTURING GAS. Silas C. Salisbury, New York, N. Y. Filed August 15, 1876.
- 187,756.** APPARATUS FOR UTILIZING GAS AS A FUEL. Wm. Hainsworth, Pittsburg, Pa., assignor to himself, H. W. Paterson and J. Irwin, same place. Filed February 3, 1877.
- 187,765.** GAS-SHADE HOLDERS. T. F. McGann, Boston, Mass. Filed June 29, 1876.
- 187,768.** HINGED COVERS FOR GAS-RETORTS. Peter Munzinger, Philadelphia, Pa., assignor to Morris, Tasker & Co. (limited), same place. Filed March 29, 1876.

March 6th.

- 188,154.** GAS AND WATER REGULATORS. W. D. Leavitt and B. J. Thurston, Cincinnati, Ohio, assignors of one-third their right to J. W. Hadlock, same place. Filed January 19, 1877.

March 20th.

- 188,473.** APPARATUS FOR THE MANUFACTURE OF GAS. A. C. Lippitt, New London, Conn. Filed March 22, 1876.
- 188,553.** GAS-RETORTS. George W. Todd, Pittsburg, Pa., assignor to himself, T. F. Grubbs and J. T. Speer, all of same place. Filed December 14, 1876.
- 188,667.** CARBURETERS. John A. Pierce and Francis E. Smiley, Philadelphia, Pa. Filed December 11, 1876.

March 27th.

- 188,740.** GAS-REGULATORS. A. Kipp, Jr., and H. Murphy, Sing Sing, N. Y. Filed November 23, 1876.
- 188,807.** GAS-LIGHTERS. Edward Lindsley, Cleveland, Ohio. Filed March 6, 1877.

188,886. GAS-BURNERS. James Anderson, Boston, Mass. Filed January 2, 1877.

188,919. GAS-CARBURETERS. Wm. W. L. Kemp, Baltimore, Md., assignor of one-half his right to C. M. Kemp, same place. Filed February 1, 1877

April 3d.

7,590. PROCESSES AND APPARATUS FOR MANUFACTURING ILLUMINATING-GAS. J. Rigby, Montreal, Quebec, Canada. Patent No. 186,692, dated January 30, 1877. Filed March 12, 1877. (Reissue).

7,591. MACHINES FOR CHARGING GAS-RETORTS. Thomas F. Rowland, Green Point, Brooklyn, N. Y. Patent No. 131,564, dated September 24, 1872. Filed December 18, 1876. (Reissue).

7,592. APPARATUS FOR RAKING GAS-RETORTS. Thomas F. Rowland, Green Point, Brooklyn, N. Y. Patent No. 127,486, dated April 1, 1873. Filed December 18, 1876. (Reissue).

April 10th.

189,490. CARBURETERS. John J. Paquette, New Orleans, La. Filed February 20, 1877.

7,601. REGISTERS FOR GAS AND WATER METERS. J. J. Squire, St. Louis, Mo., assignor, by mesne assignments, to H. E. Towle, New York, N. Y. Patent No. 37,832, dated March 3, 1863. Filed October 3, 1876. (Reissue).

April 17th.

189,575. GAS-APPARATUS. James Rigby, Montreal, Quebec, Canada. Filed March 19, 1877.

189,576. PROCESSES AND APPARATUS FOR MANUFACTURING GAS. James Rigby, Montreal, Quebec, Canada. Filed March 20, 1877.

189,645. CARBURETERS. James M. Palmer, Boston, Mass., assignor of one-half his right to George G. Shaw, Biddeford, Me. Filed February 22, 1877.

189,683. GAS-REGULATORS. J. Bassemir, Brooklyn, N. Y. Filed December 23, 1876.

189,695. GAS-KEYS. A. G. Buzby, Philadelphia, Pa., assignor to E. Anthony, H. T. Anthony and V. M. Wilcox, New York, N. Y. Filed February 16, 1877.

189,702. LAMP-LIGHTERS. H. W. P. Colson, Buffalo, N. Y. Filed January 22, 1877.

189,724. GAS-HEATERS FOR SOLDERING IRONS. George R. Gleason, Chicago, Ill., assignor to Wilson Packing Co. Filed March 7, 1877.

189,787. NURSERY GAS AND HEATING STOVES. S. Rothschild, Jr., Brooklyn, N. Y. Filed January 2, 1877.

189,799. SHADE-HOLDERS AND GAS-BURNERS F. S. Shirley, New Bedford, Mass. Filed March 21, 1877.

April 24th.

189,873. GAS-MACHINES. F. W. Ofeldt, Newark, N. J., assignor to himself and C. C. Coates, same place. Filed December 28, 1876.

189,916. GAS-BURNERS. F. T. Bliss, New Haven, Conn., assignor of two-thirds his rights to J. W. S. Peck and C. A. Chase, same place. Filed February 22, 1877.

189,971. MANUFACTURING ILLUMINATING GAS William H. Tupper, New York, N. Y., assignor to Amos N. Titus, same place. Filed March 10, 1877.

May 1st.

190,163. GAS-GENERATORS. T. S. Stewart, Philadelphia, Pa. Filed June 13, 1876.

190,308. OIL AND GAS-STOVES. Dexter W. Goodell, Florence, Mass., assignor to Florence Machine Co., same place. Filed April 4, 1877.

May 8th.

190,481. GAS-BURNERS. J. Halstrick, Jr., Boston, Mass. Filed December 22, 1876.

May 15th.

190,714. GAS-CARBURETERS. Charles A. Enggren, Brooklyn, N. Y. Filed August 18, 1876.

190,868. CUT-OFFS FOR GAS AND WATER PIPES. Fredk. Jarecki, Erie, Pa. Filed March 24, 1877.

190,915. REGENERATIVE GAS-FURNACES. C. W. Siemens, Westminster, England. Filed November 15, 1876.

190,918. GAS-HOLDERS William Smith and Roland H. Smith, Pittsburg, Pa. Filed October 12, 1876.

May 22d.

190,979. FLOATING SIGNAL-LIGHTS. Richard Pintsch, Berlin, Prussia. Filed January 23, 1877.

191,064. ADJUSTABLE CHANDELIERS. R. Marsh, Flushing, N. Y. Filed March 14, 1877.

- 191,144.** HYDROCARBON-BURNERS AND GAS-GENERATORS. C. Holland, Chicago, Ill. Filed April 3, 1877.

May 29th.

- 191,381.** OIL-GAS BURNERS. Christian G. Spengler, Hoboken, N. J. Filed November 16, 1876.
- 191,399.** EXTENSION CHANDELIERS. John T. Bruen, Brooklyn, N. Y. Filed February 22, 1877.
- 191,402.** GAS-REGULATORS. A. F. Chase, Fall River, Mass. Filed April 7, 1877.
- 191,498.** GAS-BURNERS. H. A. Whitney, Cincinnati, Ohio. Filed April 4, 1877.

June 5th.

- 191,531.** PORTABLE GAS-APPARATUS. D. H. Irland, New York, N. Y. Filed May 3, 1877.
- 191,546.** HYDROCARBON INJECTORS. H. E. Parson, Watertown, N. Y. Filed April 26, 1877.

June 12th.

- 191,749.** PROCESSES FOR MANUFACTURING CARBURETED-HYDROGEN GAS. J. H. Bowman, Warren, Pa. Filed June 12, 1876.
- 191,766.** PROCESSES AND APPARATUS FOR MANUFACTURING ILLUMINATING-GAS. M. W. Kidder, Boston, Mass., assignor to himself and Person Noyes, same place. Filed May 4, 1876.
- 191,789.** GAS AND AIR CARBURETERS. W. H. Winn, New York, N. Y. Filed January 11, 1877.
- 191,808.** APPARATUS FOR THE MANUFACTURE OF ILLUMINATING-GAS. Philip W. Mackenzie, Blauveltville, N. Y. Filed August 16, 1876.
- 191,860.** GAS-REGULATORS. S. S. Jones, Norristown, Pa. Filed May 5, 1877.
- 191,877.** BY-PASS VALVES FOR GAS-WORKS. Peter Munzinger, Philadelphia, Pa, assignor to Morris, Tasker & Co. (limited). Filed October 10, 1876.
- 191,888.** PROCESSES FOR THE MANUFACTURE OF GAS. Thomas B. Redwood, Fairlawn, Finchley, England. Filed August 26, 1876.
- 191,912.** CARBONIC-ACID-GAS GENERATORS. Otto Zwietusch, Milwaukee, Wis. Filed April 26, 1877.

- 191,921.** GAS-APPARATUS FOR HEATING TOOLS. Peter Bradley, Philadelphia, Pa., assignor of one-half his right to James Bradley, same place. Filed May 3, 1877.
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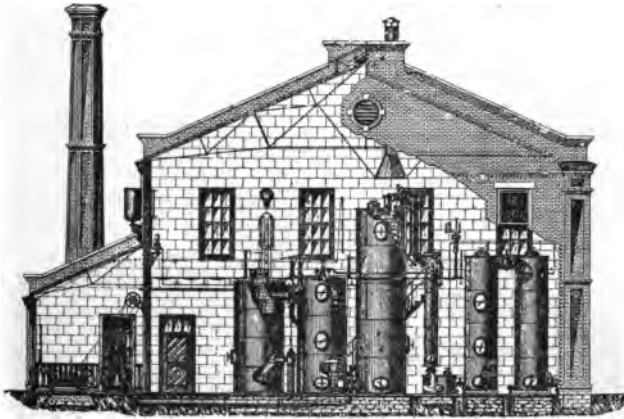
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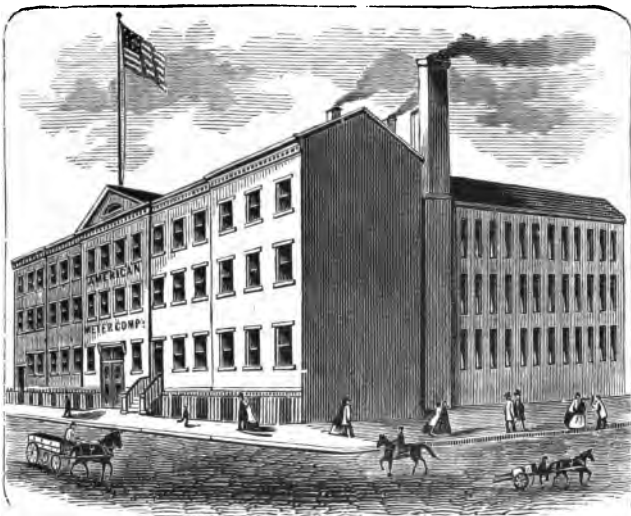
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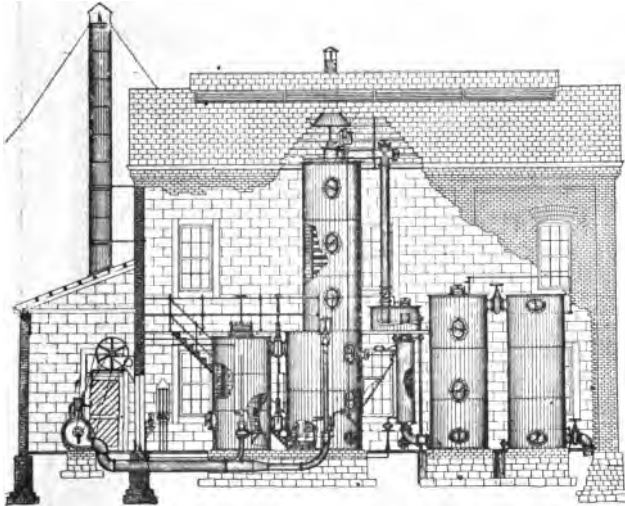
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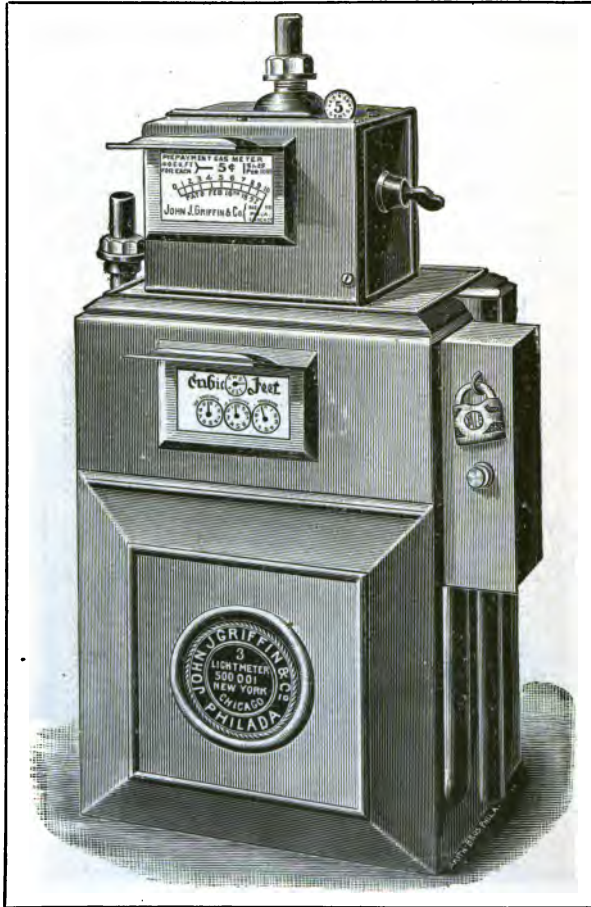
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W. H. Pearson

THE PROCEEDINGS

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Vol. XI., No. 2.

OCTOBER, 1894.

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A SMALL EXPERIMENTAL PLANT AS AN AID TO THE MANAGEMENT OF A COAL GAS WORKS.

WRITTEN FOR THE AMERICAN GAS LIGHT ASSOCIATION, BY PETER YOUNG,
KNOXVILLE, TENN.

In small gas works, such as I am connected with, it is always a very serious question with the manager, if he has a variety of coals to choose from, which coal shall be used; if he has been using a good coal, he feels like standing by the old adage "Let well enough alone," and yet if he be a progressive man this will not suit his nature. In a section of country where new mines are being opened almost daily, the matter becomes still more difficult, as every new vein is always the "very best gas coal" yet discovered, at least so say coal men. As a general thing, we are compelled to draw largely from the experience of others in the purchase of all our supplies, not having means at our command to experiment much for ourselves in the plants we are operating, and if everything we do is not at least partially successful, we feel it in diminished profits, and where these are small, if a bad contract on coal is made, it would make quite a difference in the dividend at the end of the year. In making

trials of coal on three or four benches, there are so many things that may happen, that we are very liable to discard a good coal and take one of a poorer quality, for instance;—the sample sent may be wet, and as we only try enough of it to last, say one week, the heats might be low, a stoker sick and a green hand in his place, etc., etc., and the results may not be as good as shown by an inferior coal when heats are good and everything working smoothly, and another point is this;—we usually pay for this coal, about what we pay for the coal we have been using; if this is better, all well and good, but if it proves a failure, we have lost enough on that one test to put in a small apparatus where we can test a small sample, which the coal men give us free of cost, under about the same conditions, be our own stoker, keep up the heats, etc., etc., and see in a few hours, at a very slight expense, that it takes a week under trying conditions, to find out. What one sees and does himself he can feel more confidence in, than if the same thing be left to the average night foreman, and stokers who are descendants of Ham, and it is hardly possible for the Superintendent to sit up night and day for a week, to see that a coal has all the advantages it should have.

These thoughts led me to the belief, about two years ago, that a small, inexpensive experimental plant, to determine the values of coal, would be a profitable investment. Not for scientific research, but to save dollars, although as an aid to the technical analysis of coal, etc., it can be used to good advantage. With this lengthy preamble, I will proceed to describe as briefly as possible, how the apparatus is built and used.

Having a room in one of our buildings that had been used as a store room, and not needing it for that purpose any longer, we utilized it for this apparatus and a photometer room. Around most gas works there are plenty of old fire-brick hardly good enough to be put back in a bench and not much use for anything else. During spare moments, the foreman and I built a small bench four feet long, three feet wide and five feet high. The wall of the building formed the back of the bench, side walls, nine inches; arch, eighteen inches. The furnace is twelve inches wide, and the retort rests on tile directly over it; the

products of combustion are taken up at the back end of arch, brought forward to the front and taken out through the top. The first retort we used, was a piece of old eight-inch cast iron pipe, but it soon burned through and we had one cast, the iron being one inch thick, inside diameter of retort six inches, with flange on one end fifteen inches diameter, with two holes drilled in it to receive lugs for cotter bar. The lid was made from a piece of boiler plate, with one-half inch bolt tapped into it to handle it by. A two-inch hole tapped back of the flange is the outlet. We use no hydraulic main, simply a stop-cock. From the retort it is led over by one and one-half inch pipe to a coal condenser, made from one and one-half inch pipe and return bends, each bottom return being tapped to receive a drip made from one-half inch nipple, one inch by one-half inch reducer, and a one inch nipple seven inches long with cap on end. From condenser, the gas passes to the washer box, simply a tin box, eighteen inches by twelve inches, by nine inches, filled with water to within three inches of the top, and in which the gas is made to bubble through two inches of water. Next comes a purifier, two feet six inches square, by one foot deep, in which are put the different materials used for purification. The meter used at first was a twenty light dry meter, and by observing the test dial, the results were determined; but we found the diaphragms became dry and the meter inaccurate, as the temperature in the room sometimes gets very high, so we had a twenty light wet meter made, registering tenths, feet, and tens of feet. The holder and tank are both of wrought iron; the holder three feet in diameter and five feet deep; tank three feet six inches in diameter, and five feet deep. This holder gives a pressure of forty-nine tenths, and the outlet is connected to the bar photometer, and also to the main leading to the holder of the works. When cupped, our large holder gives a pressure of fifty-two tenths, so that by adding weights to the small holder we can empty it into large one and can also fill small one from large one. For filling we have a connection at inlet of condenser, so that all the air can be expelled from apparatus before beginning a test. After the retort is sufficiently hot, and the apparatus free from air, a given quantity of coal is put into the retort, in an iron pan, which has been weighed.

We usually charge four pounds, if cannel coal is to be tested, and five pounds of common bituminous coal, for of course, the larger the quantity used, the less liability to error in figuring results per ton. After the gas has all been expelled, it is tested for candle power on the photometer. The average of three such tests, we consider a fair trial. The coke is weighed, and the result, multiplied by five hundred or four hundred, as the case may be, gives the coke per ton. This is also a fair test for the volatile matter in the coal, and a sample of the coke tested in a crucible, gives the fixed carbon and ash. The amount of tar taken from the drips, can either be measured or weighed, and the amount per ton ascertained as before. After having obtained the quantity and quality of the gas made, corrected to standard temperature and pressure, the yield of coke and tar, we then make another charge, and test the crude gas with a Cooper's tube, or eudiometer, as described in Hartley's Gas Analysts' Manual, by Mr. Steadman and Mr. Thwing, at some of the meetings of the Western Gas Association. Our whole apparatus, not including our photometer, did not cost one hundred dollars, and we consider it has paid for itself many times over, in the two years we have had it in use. We are not able to get as good results in practice, as are obtained in the experimental works, but it is a good lesson to teach what we should strive for. It also enables the Superintendent to know the maximum quantity and quality of gas that can be obtained from a given quantity of coal. As before remarked, this apparatus is not meant for scientific purposes, but as a simple means of obtaining a comparative test of different coals, and if the same conditions prevail during each test, then the tests may be depended on as a standard by which to purchase our coal.

SOME EXPERIENCES WITH THE WELSBACH INCANDESCENT GAS LAMP.

WRITTEN FOR THE AMERICAN GAS LIGHT ASSOCIATION, BY W. S. RATHELL,
CAIRO, ILL.

In these days of close competition between gas and other means of illumination, with incandescent electric lights in many instances sold at cost, and too often, indeed, at less than cost of production, with the arc lamp no longer a commercial luxury but rather, indeed, a commercial necessity, and with carbon oils sold at a price which place these oils in line as the most dangerous competitors known to the gas industry, any article of merit which promises an increased amount of illumination with a decreased gas consumption, is looked upon with favor and sought after diligently by the progressive gas manager.

The days of excessive pressure, exorbitant gas bills, poor service and wasteful burners, coupled with a successful and dividend paying gas company, have ceased to exist.

Either the public must be supplied with the best that can be had, and that too, with the least possible outlay of money, or they will discontinue the use of gas as an illuminant, and the dividend days of the company fail to dawn.

In the gas business, as in all other legitimate businesses, the customers have a right to expect the very best article that can be obtained for the money, and not only have they that right, but in this particular line of business, they have the right to be supplied with, and educated in the use of the very best and most economical appliances that may be had to use our product through.

One of the principal secrets of a successful gas business (if there are any secrets in the business?) is this;—First; Make as cheaply as possible, and of as good quality as can be obtained, all the gas that you can sell, and Second; Use all means at your

command, day and night, winter and summer, to sell all the gas that you can make.

The question is, how can this be done?. Evidently not by the use of antiquated and exploded methods, not with exorbitant bills, poor service, poorer light and kicking customers, but it may be accomplished by the intelligent use of modern appliances, supplied with the best article that we can produce with modern means of production. My experience has taught me that a dissatisfied customer is next in injury to an opposition company, and that one thoroughly satisfied customer is the best canvasser known for the gas company.



FIG. 45. WELSBACH INCANDESCENT GAS BURNER.

Using the foregoing as the leading rules of our business policy, our company early in 1892 began experimenting with the Welsbach Incandescent Gas Lamp, this lamp at that time

not being nearly so well perfected as now. Our first use of the Welsbach was merely an experiment, being confined at first to a couple of lamps at our office, and one in the sitting-room of my residence, the company preferring to thoroughly test the utility of the lamp before offering them to our customers.

In September, 1893, we began introducing these lamps among our customers, first, as a means of withholding our customers from the outstretched arms of a competing electric light company. To-day we have over eight hundred of these lamps in daily use in this small town, fully fifty per cent. of which have displaced either incandescent or arc electric lights.

We manufacture at Cairo a straight coal gas of approximately eighteen candle power, using only Youghiogheny coal and a small percentage of cannel, and it was with this gas that the following tests of the Welsbach burner were made:

The first test of the burner was made in the early fall of 1893, and was a test for deterioration of mantle and consumption of gas. This test was made by placing a Welsbach on a fixture connected between the holder and the street pressure governor, interposing a meter between the burner and the main, the pressure, 25-tenths, being the initial pressure of the holder; the statement of the meter was taken, the gas turned on and lighted, and a record of hour and date made. This burner was in continuous use for the space of 1,921 hours, at the end of which time the mantle was destroyed by reason of breaking of the wire support that holds the mantle in position. The amount of gas consumed during these 1,921 hours, was 6,474 cubic feet, or 3.37 feet per hour.

The next test attempted was to find as nearly as possible the amount of heat developed for a given amount of light produced both by the Welsbach and the ordinary gas burner. For the want of better method for making such a test, I employed the following method of finding the relative amount of heat produced both by the Welsbach and by the ordinary Bray burner:

I took a number each of No. 4, No. 5 and No. 6 Bray burners, and tested each on a test meter, selecting six of each number, each burner in its respective number, consuming the same quantity of gas per hour under a uniform pressure of 15-tenths. The rate of consumption per hour being as follows:

No. 4 Bray, 3.8 cubic feet per hour.

"	5	"	4.5	"	"
"	6	"	5.8	"	"

I next took, at random, from a package of 100 Welsbach lamps, one No. 20 Welsbach lamp and tested it under the same pressure on the same test meter, and found it to consume 3.2 cubic feet per hour. I then took a vessel and accurately measured one pint of water and placed it in the vessel. Taking the temperature, the water was found to be 52° F. I suspended

the vessel above the Welsbach in such a manner that the bottom of the vessel was exactly 6" above the top of the Welsbach chimney. The gas was then lighted, and allowed to burn exactly five minutes and then extinguished, when the reading on the thermometer was 94°. The thermometer being suspended in such a manner that the bulb was entirely submerged in the water while being heated.

This operation was repeated, first with a No. 4 Bray and then with a No. 5 Bray, the same conditions of the first test being accurately observed, and the bottom of the vessel being 6" above the top of the flame. The No. 4 Bray raised the temperature from 52° to 88° in five minutes, and the No. 5 Bray raised the temperature from 52° to 94° in five minutes.

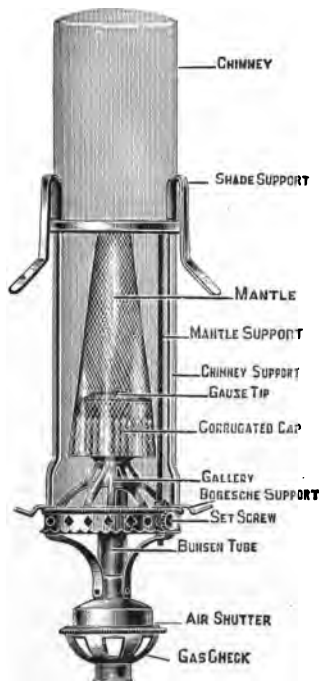


FIG. 46. DETAILS OF WELSBACH BURNER.

From the above it will be observed that the amount of heat developed by the Welsbach burning 3.2 cubic feet per hour, and the No. 5 Bray burning 4.5 cubic feet per hour, were exactly equal, and so it was found that 3.2 cubic feet of gas burned through a Welsbach in one hour develops the same heat units

as 4.5 cubic feet of the same gas burned through a No. 5 Bray in one hour.

Having no bar to test the illuminating power of the two burners, recourse was had to the following ocular test.

I prepared a board twelve inches wide and about five feet long, and taking another piece of board two feet long, nailed it to the end of the longer board so that the longer board stood in the center of the shorter one when the shorter one was placed face to the floor. Next a paragraph was selected in a daily paper, the paragraph marked, and the paper tacked to the upright board, so that the paragraph would be on a horizontal plane with the center of the Welsbach light. Lighting the Welsbach, I placed the upright board with paper attached, in line with the burner and at such a distance that the reading was entirely obscured. I then moved the board toward the lamp slowly, until the paragraph was plainly legible. The board was then fastened in its position to the floor. Next, I took a number of nipples and tees and placed six No. 5 Bray burners in a line four inches from center to center, each burner being supplied with its own key. Removing the Welsbach the six burners were placed in such a manner that the center of the flames would be level with the paragraph on the board and at exactly the same distance from the board that the Welsbach occupied, the six burners being in line across the face of the board. Commencing from the center burners, I lighted one after another, examining the paper after each burner had been lighted. When four of these burners had been lighted, I was able to read the paragraph. I then extinguished one burner, when I was unable to read, re-lighting the fourth burner, the printing was again legible.

Now, as the No. 5 Bray consumed 4.5 cubic feet per hour and it required four No. 5 Brays to equal in light one Welsbach which consumed 3.2 cubic feet, we have $4 \times 4.5 = 18$ cubic feet of gas burned in one hour through four No. 5 Brays equals in illumination 3.2 cubic feet of gas burned through one Welsbach in one hour, and as the heat developed from one Welsbach equalled the heat developed from one No. 5 Bray, hence we get four times as much heat from the same volume of light by using the gas through ordinary burners as we do by obtaining the same

amount of light from Welsbach burners, or if the same amount of light is required, we get 1-4 as much heat from Welsbachs as we would get from ordinary burners.

Now, assuming the gas used to have been 18 candle, we have $18 \div 5 = 3.6$ candles per foot, and as it required four burners, using 4.5 feet to equal in light one Welsbach using 3.2 feet, then the four burners produced $4 \times 4.5 \times 3.6 = 64.8$ candles as the efficiency of the Welsbach burner, and from the above we get the following: $\frac{64.8 \text{ candles}}{3.2 \text{ feet}} = 20.25$ candles per foot as the efficiency of the Welsbach burner.

Now, using the above formula let us suppose a consumer using 12 No. 5 Brays, who was entirely satisfied with his light but not with his bill, by installing three Welsbach we get the same quantity of light with a consumption of $3 \times 3.2 = 9.6$ cubic feet per hour, whereas his old burners used $12 \times 4.5 = 54$ cubic feet per hour. Now let us suppose he used his light five hours per day for 30 days each month and his gas was purchased at \$2.00 per M. net, we have

$$\begin{aligned} 5 \times 30 \times 54 &= 8,100 \text{ cu. ft. at } \$2.00 = \$16.20 \text{ Brays.} \\ 5 \times 30 \times 9.6 &= 1,440 \text{ " " " } 2.00 = 2.88 \text{ Welsbach.} \end{aligned}$$

Showing a saving of \$13.32 for the month, light for light. But my experience here has been that customers prefer better light and invariably want one Welsbach in place of each ordinary burner. Under the circumstances we have the following:

$$\begin{aligned} 5 \times 30 \times 54 &= 8,100 \text{ cu. ft. at } \$2.00 = \$16.20 \text{ Brays.} \\ 5 \times 30 \times 38.4 &= 5,760 \text{ " " " } 2.00 = 11.52 \text{ Welsbach,} \end{aligned}$$

with four times as much light, with a saving of 28.8 per cent. in gas bills, and here I will say that in the case of seven of our consumers, selected at random, who had introduced the Welsbach, taking five months during the fall and winter of '93 and '94 and comparing them with the corresponding months the previous year when they were using ordinary burners, the saving was shown to be from 32 to 52 per cent.

Having considered the Welsbach as in competition with ordinary gas burners, let us now turn our attention to gas through

the Welsbach as in competition with incandescent electric lights, and for the purpose of this comparison let us place the selling rate of electric current at ten cents per M. Watt hours, and the selling rate of gas at \$2.00 per M. net.

We find first, one Welsbach using 3.2 cubic feet gives 64.8 C. P. and one electric light at best 16 C. P., hence four incandescent electric lamps equal one Welsbach gas lamp nearly. Now four incandescent electric lamps on circuit having a pressure of fifty volts and using one ampere will give 200 Watts per hour.

Now let us suppose one Welsbach burning five hours per day for thirty days using 3.2 feet per hour, we have,

$3.2 \times 5 \times 30 = 480$ cu. ft. at \$2.00 per M. = .96 Welsbach.

$5 \times 30 \times 200 = 30,000$ Watt hours at .10 per M. = \$3.00 Electric
or an equal amount of light from gas at a saving of \$2.04 on each Welsbach placed.

From this we find that gas burned through a Welsbach incandescent gas lamp at \$6.00 per M. cubic feet, can compete with incandescent electric lamps with current sold at 10 cents per M. Watt hours, and further as an equal number of Welsbach burners can displace an equal number of incandescent electric lamps at a saving of about 12 cents per month, on each four Welsbachs, gas being \$2.00 per M. over the cost of incandescent electric lamps and get four times the volume of light, and as the cost of renewals from two years experience has proven this item is not greater in the Welsbach than the electric, if as great, it does not appear that we need have any great fear of electric competition if we chose to use the Welsbach.

The use of the Welsbach with us, while it certainly has reduced individual bills very materially, yet has not affected our total output, which has increased in the past year notwithstanding the dull times and the further fact of our gas company having two electric light plants to compete with, one of which is controlled by our company; the other is not, by any means. Our experience has been that when Welsbachs are installed in a dwelling, the owner invariably finds that he can afford a gas stove if he has not one already and if he has one already he finds that he can afford to do the family laundry on the gas stove as well as the cooking. The business man finds his bills very much reduced, and he quite readily persuades himself that

more light means more business and he at once gets it by increasing the number of his lamps. We made quite a canvass with the Welsbach, placing some on trial at different places, and they were always paid for and an order followed for more. Quite often one Welsbach placed on trial with an electric light consumer, has resulted in turning the consumer to the exclusive use of gas. Four burners placed in a hotel in this city resulted in seventy-four being placed, and besides this, some of our hardest kicking customers have become so fully convinced, that they are recommending the use of gas. We thought, last season, that we had reached about the limit of gas stove sales, in other words we thought the town was fully supplied with gas stoves, yet this season we have sold about seventy-five additional stoves. Our town is not increasing in population to any great extent, and as we have some 1,200 meters among a population of 12,000 or 13,000 inhabitants, about one meter to every ten persons, it is seen that nearly all worth having are using gas in some shape or other, particularly when it is known that one-third of our population are negroes whom we do not desire as consumers. The larger number of stoves sold have been to those already using gas and quite a number of the sales are traceable to the good results and the good feeling brought about by the use of the Welsbach. Now the question arises, shall we adopt the Welsbach and diminish our present individual bills and look for the return of revenue from other sources of consumption made practical by the Welsbach, or shall we stay exclusively by the old style burner with its seemingly high bills, and gradually turn our consumers over to electric light and carbon oil.

NOTE BY THE EDITOR.—For convenience in looking up the literature on Incandescent Lighting and Burners, the following table of references indicate most, if not all of the articles that have lately appeared in the American Gas periodicals. See also references under LIGHTING, A. G. L. A. Proceedings, Vol. XI, No. 1, Page 102, also general reference list in this number under the head of LIGHTING:

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ONE OF THE FIRST METER MAKERS IN THE UNITED STATES.

WRITTEN FOR THE AMERICAN GAS LIGHT ASSOCIATION BY H. C. SLANEY,
OF BROOKLYN, N. Y.

The object of this paper is to clearly demonstrate some vague points that have not been touched upon lately, about the earlier workers, as the title suggests, and to furnish a personal and partial history of an almost unknown and unheard of meter manufacturing company, together with that of its founders, known as the "Phoenix" Meter Company, of Baltimore, Md.

There has been but very little information published about the earlier manufacturers of gas apparatus in this country. Those hardy pioneers' names should be rescued from obscurity and their memory perpetuated in the archives of this Association, instead of remaining as now, in a vale of mystery. The older members of this profession knew of their trials, but for the benefit of the younger members it occurred to the writer that a few rambling notes, gathered at odd times, upon the struggles of one of the first meter makers in this country, would not be amiss and would help to preserve the names of those who were identified with the early introduction of gas into the United States.

When gas companies first began to organize they were strictly close corporations, and every movement was guarded with utmost secrecy. Therefore it is almost impossible to gather information in regard to their organizations or modes of working, except from those who were then closely associated with the different companies. In furnishing this mite of history, it has been the writer's fortunate privilege to transmit the inclosed facts from an active worker in the gas industry at the time when meter manufacturing first began here.

From various sources I have gathered the following dates for the several cities, about when they commenced to manufacture and furnish gas for the public consumption. If these dates are

incorrectly stated, I hope some member will set me right by furnishing the correct dates. Baltimore, 1817; Boston, 1822; New York, 1823; Philadelphia, 1835; Chicago, 1840; Cincinnati, 1841.

The "Gas Light Company of Baltimore" received their charter Feb. 5, 1816. An ordinance was passed authorizing the company to lay pipes June 17, 1816.

The first public lamp lighting was on Feb. 7, 1817.

The above compilation would make it appear that this was the first successful gas company, and it is now my intention to contend that the city of Baltimore may be called the foster-mother of the gas industry, both as to successfully manufacturing of gas and of making of meters, although it was in Philadelphia that gas was first produced and exhibited by Michael Ambrosie & Co., at their amphitheatre on Arch street, between 8th and 9th Sts., in the year 1796. It was also successfully attempted several times during a period of about eighteen years in that city by other firms. Yet it was not until March 27, 1835, that the council passed an ordinance for the construction of the Philadelphia Gas Works. They were finished, and the first gas was manufactured Feb. 8, 1836. Gas was also successfully produced in 1813, by other persons, to be used in lighting up of mills in Rhode Island and other places.

It may seem evident to you that I have digressed somewhat from my subject, but a portion of the above historical facts will be referred to subsequently in trying to establish the title of this paper. Now let us revert to a period some sixty-two years ago.

The first meters known to be manufactured in the United States, were made in the city of Baltimore by Mr. Samuel Hill, about the year 1832, (cannot positively verify the date.)

The second maker was Mr. John Rodger, also of Baltimore, a machinist, under the supervision of Mr. John M. Slaney, in 1832.

The third maker was Mr. C. Young, of New York, in about 1835.

The fourth maker was the firm of Colton & Code, of Philadelphia, in about 1839. This firm also made the first station meter.

This is as far as I care to extend the above summary of meter makers in the present papers, for as stated above, this is merely a personal sketch of one of the pioneers. Mr. John M. Slaney, grandfather of the writer, referred to in connection with Mr. Rodger, learned his trade in London, and came to this country in 1829, settling in Philadelphia.

The Baltimore Gas Company imported all their meters from England; the last importation was a small shipment in the beginning of the year 1833. These were all wet meters, and made by Samuel Crosley, of London. I wish to call special attention to a list of various size meters, together with their prices, published for the first time, to my knowledge. By comparing the list of sizes with that of the present day, you will notice how closely the makers have followed in the footsteps of their predecessors. The only deviation from this list was the 50-light to a 60 light, and the addition of 80-lights. There were a few other sizes which I could not gather information upon at this time. Their selling price, as compared with the present average price, is over $2\frac{1}{4}$ times greater, as per the following:

<i>Size Meter.</i>	<i>Price, 1833.</i>	<i>Price, 1894.</i>
3 lights.....	\$13.88.....	\$5.63
5 ".....	16 50.....	7 13
10 ".....	20.50.....	9.00
20 ".....	27.50.....	12.38
30 ".....	36.50.....	16.87
45 ".....	50 00.....	24.75
50 ".....	68.50.....	60-light 33.75
100 ".....	100.00.....	56 25
150 ".....	225.00.....	86 25

In the year 1832, Mr. John Rodger secured a contract to manufacture 1,000 gas meters for the Baltimore Gas Company, and as Mr. Rodger was not a meter maker, but a machinist, he then proceeded to secure the service of Mr. John Slaney and persuaded him to go to Baltimore, to equip and superintend his meter shop. He continued with Mr. Rodger in that position for two years.

In the year 1834, at the solicitation of Mr. James Mowton, secretary of the Baltimore Gas Co., Mr. Slaney entered their service as superintendent of their meter department. He opened



Fig. 47. METER BADGES OF SOME OF THE EARLY AMERICAN MAKERS.

and equipped a shop for supplying the company with all new meters required, and to repair those that had been in use and set aside for months, in fact some for years. He remained with the gas company until 1849.

It has been stated at various times that Messrs. Colton and Code commenced the manufacturing of meters in Philadelphia, during the year 1834. Mr. Code, who was in the employ of Thomas Crosley before coming to this country, was also very well acquainted with Mr. Slaney, and paid him a visit at the gas works in Baltimore, while on a trip to the West from New York in 1838, prior to going into business.

Mr. Colton, of Philadelphia, it has been reported, was a brother-in-law of Mr. Baldwin, of locomotive fame, and had been for some time endeavoring to manufacture meters; but owing to his inexperience in this line had not succeeded to his satisfaction, when Mr. Code, who was an experienced workman, arrived in Philadelphia on his return trip, sought out Mr. Colton. Here is an observed difference of four years between these dates.

To substantiate what I have written, I shall quote from the 3d Annual Report of the Trustees of the Philadelphia Gas Works, Jan., 1838. The explicit language used was:—"Notwithstanding the desire of the trustees to procure meters of American Manufacture, they found themselves obliged to resort again to England for this year's supply." The number imported in 1837 was 343. Then again we shall refer to the 5th Annual Report of the Trustees, January, 1840. It asserts: "The meters furnished by one of our own fellow citizens, thus far, proved highly satisfactory, and, as yet, there has appeared no reason to doubt that they are equal to those introduced from abroad." The above quotations prove, I think, that Mr. Colton, together with Mr. Code, gave the firm its name and existence about the year 1838 or 1839.

It has also often been stated that the Manhattan Gas Co. commenced to manufacture gas meters in the year 1834. This I cannot credit as a certainty, from the assertions set forth by the late Charles Roome, Esq., President Manhattan Gas Co., who stated that he was a junior clerk when Mr. Code was employed to repair meters for his company. Mr. Roome writes in the American Gas Light Journal under date of Oct. 16th, 1876,

that "Theo. Code of London was employed by the Manhattan Company to repair the meters for awhile, when he joined with Mr. Colton of Philadelphia and established the house of Colton & Code, which soon became a strong and highly prosperous establishment." From the above information, should infer that the Manhattan Company did not make new meters, but only did their own repairing in 1834, and for a few years after.

It is my sincere belief that Mr. John M. Slaney (father of the writer) is one of the oldest living gas meter makers in this country, and it is to him that I am greatly indebted for this important historical matter.

He was apprenticed to the meter department of the Baltimore Gas Co. in 1837, and left their service in 1839. Re-entered and left their service again in 1848 to begin business for himself.

In this year Mr. John M. Slaney, with Mr. Charles Collier, formed a co-partnership to manufacture meters, under the title of Collier & Slaney, Concord street, Baltimore, Md. They continued business until 1850, when they dissolved partnership. Collier & Slaney received a diploma from the Maryland Institute Fair for a "Gas Meter," on the 20th of November, 1848. It was during this year that they made their first station meter, for Zanesville Gas Co., Ohio.

In the year 1850, Mr. Slaney, his father and two other gentlemen, organized the Phoenix Meter Company, No. 44 Holliday St., Baltimore.

This Company did splendid work, and the exhibition made by them in the Maryland Institute Fair in 1853, was greatly appreciated; for this exhibit they received a silver medal. This medal, together with several of the above meter makers' badges, are now in possession of writer, and it will afford him great pleasure to show them to members of this Association.

The peculiar situation of this city in those days, was that it lay upon the border line of the free and slave cities. Goods were bought in the North to be sold in the South; this transaction was the cause of considerable embitterment and jealousy throughout business circles. A merchant to carry on business successfully, was compelled as a moral suasion, to agree with both sides of that, then, live question. Communication between cities were few and far apart. Railroad traveling was quite an

undertaking; there were but few trains a day, and tickets purchased at the railroad stations were only good for that specific time and train. Mail delivery, as compared with that of today, was so slow that a letter sent with an inclosed bill, often found the debtor dead upon arriving at its destination, consequently collections were very hard to make, and when made, the payments were invariably in "shin-plasters" and "wild cat" bank notes, which was like the "Irishman's flea," when you put your hand on them their value was not there.

It was a painful positiveness in those days, for a person to go to market with a basketful of money, (shin-plasters) and a privilege, after continual discounting, to bring home a pound of meat. Note-shaving was quite a profitable business, and it was carried on to perfection.

When the great panic of 1857 swept with havoc over the land, the Phoenix Meter Company, with so many of its unfortunate contemporaries, was obliged to fail; not from mismanagement or the lack of business, or the want of confidence, but from the depressed value of "shin-plasters" and "wild cat" money, and banks demanding triple indorsers on paper, which at certain times was almost impossible to secure.

The Phoenix Meter Company did a prosperous business furnishing meters to gas companies in the principal cities throughout this country and Canada. Some conception may be formed of their flourishing condition, from the following extracts from a book called "Baltimore as It Is," published in 1857. I shall quote only a small portion of that article, and of the part that relates to this subject. "The works of this company are situated at No. 44 Holliday street, and are divided into several distinct departments, each provided with the most novel and ingenious machinery, worked by steam power, it has ever been our privilege to examine. Indeed, the work is so complicated and regular, as to require the most perfect machines that the ingenuity of man is capable of inventing. The first department we entered was that of the foundry. Here the various brass and iron castings used in the business are made, we noticed among others worthy of note, castings for patterns of the new patent street signs, now used by our city, and a new and handsome style of cock for street-lamp posts. We next passed into the shop where

the tin bodies are made for the outside of meters. We next entered the department for making cocks and gas fittings. Following this is a department for getting out brass work for meters. Adjoining this department, is one appropriated to making of drums, or the interior arrangement of meters. Taken altogether, the gas meter may be regarded as the most wonderful invention the ingenuity of man has ever devised, for while it embraces all the minute and complicated machinery of the watch, it likewise combines the important details in natural philosophy, (and this is from a newspaper man). The next department we noticed, was for making movements for meters. This is under the direction of an experienced watchmaker. We here noticed a stationary meter with six dials, with an attachment of an eight day clock. Next following, is a room for making small gas cocks. This department is provided with a rotary shear and heading machine, for cutting and forming heads for meters. After this, comes the department for cutting out work, to do which a number of ingenious machines are used; adjoining, are two small apartments for electrotyping and taking daguerreotype views of meters. In the rear of the lower portion of the building, there is a room for proving meters after they have been finished; they are then taken into the painting room.

We observed in the course of our visit numbers of beautiful patterns, gotten up in various architectural styles, to go in front of meters. Messrs. Slaney are constantly filling orders, not only for all sections of our country, but for the British Provinces, having acquired a wide spread reputation for the beauty, superior mechanical construction, and general correctness of the meters."

Although this company played an important part in the meter history, and is now out of existence, yet some of its fruit may still exist, for one of its meters was unearthed as late as last year. If my memory serves me correctly, it was removed by Messrs. Helme & McIlhenny, of Philadelphia, from Lancaster Gas Works, Pa.

John Slaney, senior member of this company, died in Philadelphia in April, 1863, in his 69th year.

In the employ of the Phoenix Company at that time were two

Englishmen, brothers, by the name of Thomas and Harry Tansley. They were clock makers and were employed on movements. Afterward Thomas Tansley associated himself (I think) with Dickey, Baker & Co. This firm started in business on North street, almost directly opposite the Phoenix Co's old stand on Holliday street.

Then as manufacturer's pamphlets are all effusive with praise for the superior work that is bestowed upon meters of to-day, (I appreciate this from a business point of view, and here wish to urge a plea for those old workers) the present makers can advantageously perform an act of kindness by praising the excellent work of those who have passed away. They have left monuments in their wet and dry meters, and have engraved their names to fame upon the badges that adorn the front of every meter of their make.

The early maker did not have the benefit of such splendid machinery that has since been invented and introduced, to aid them in securing excellent work, but their genius was displayed in using all kinds of substitutes to procure some means by which to accomplish their purpose. If these conditions were not a fact, there would not be any incentive to workmen to think out and invent a permanent substitute to supply these wants and this has been the history from Mr. Clegg's attempt in 1815, to the present "drop a nickel in the slot" meter.

Their workmanship and material was of an excellent quality, and has been verified quite often, when exposed to view in repairing meters that have had forty years of service. This is surprisingly so, when we recall the deteriorating action upon the metal work, of foul gases that passed for a purified article.

I have been informed very recently by a gentleman who has had a varied experience throughout the country, and an excellent knowledge in repairing meters, that the material used in those old meters was better than what is often found in some of the meters of to-day, which bespeaks volumes for their judgment in selection of material used.

The leathers in diaphragms of earlier dry meters, were often found to be well preserved and in good condition, while the metal findings surrounding them were in decay with rust. Comparatively speaking, the leather was as good as new and could

have been used over again in new bodies, only this was not considered policy, from the economical point of view.

In concluding, I wish to digress once more by calling your attention to another similarity of ideas that Baltimore must mother, that is, between the use of the first station meter, and I may say that of the last one. As a matter of history, the first station meter used by the Baltimore Gas Company, was made by Clegg & Crosley in 1826. It was 48 inches in diameter, by $27\frac{1}{2}$ inches long, out to out. The drum shaft projected from the meter, or at least the gearing attached to the same, and through this medium the motive power was furnished, by which the revolving arm in the wet lime purifier was made to turn; this arm kept the cream of lime, (water and lime) agitated.

Mr. Hambleton, also of Baltimore, has conveyed by the use of gear wheels and shafting, the lost power of the meter to that of his patent oil meter, which is placed upon the top of hydrogen meter. The conversion of this power, by the utility of his meter is made to furnish, by the means of dippers, the exact quantity of oil used per thousand in the "Wilkinson Process."

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LIGHT WASTED IN BAD FLAMES.

WRITTEN FOR THE AMERICAN GAS LIGHT ASSOCIATION, BY N. W. GIFFORD,
OF NEW BEDFORD, MASS.

In presenting the following, it is not expected to set forth any new facts or theories, but rather to call attention to the large amount of light lost by the use of poor burners, or perhaps it would be better to say, the great waste caused by the improper use of good burners.

Great progress has been made in the development of burners, which shall give the greatest amount of light for the least consumption of gas, and we welcome each device which approaches this desired end. But in most cases, the increased efficiency is only secured by complicated or costly and fragile arrangements, which act as a hindrance to their general use; so that to-day the greater part of the gas used for lighting is burned in the ordinary flat flame burner.

Its cheapness, its simplicity, and its capacity to still burn gas, no matter what happens, unless the exit is completely closed, have given it this almost universal sway.

In one of the papers read before the American Gas Light Association, at the '92 meeting in Boston, the effect of tip pressure on the lighting efficiency was clearly shown. These results and some similar experiments made by the writer, show the efficiency to increase with the rate of burning, and to decrease as the pressure at the tip rises.

But I doubt if even the average gas man appreciates the amount of light thus lost by clogged and blowing burners, and it is with the hope of showing this loss somewhat graphically, that I have inserted the accompanying illustrations. The burner is the same in each case, but with a different tip. The cuts are exact reproductions of the flame photograph, even though from an artistic point of view, a little touching up might have been desirable.

In photographing the flames, the camera was focused alike for all, so the scale is the same in each, and shows the actual relative dimensions.

A, burned 5 ft. per hour at $\frac{1}{2}$ inch pressure, which, by the way, is rather too low to be safe, from a liability to smoke in a draft of air. These are conditions under which any user of gas may burn his gas with a very small exercise of care and intelligence. For the purpose of comparison its efficiency may be called 100.

B, is the same burner and same tip, burning 11.28 ft. per hour, at 1.2 inch pressure, and gave only 67 per cent. as much light per foot of gas burned as A. This style of flame is by no means an exaggeration, but can be seen in very many gas-lighted rooms. Its breezy whistle and blow convince the spectator that it is doing a big business. So it is for the gas company for the time, and it is also laying up capital for the kicker.

C, is also a 6 ft. tip, and was taken from actual use. It burned 8.07 ft. per hour, at 1.6 inch pressure, and gave an efficiency of 51.6 per cent. This, too, is by no means a rare case.

D, burned 4 ft. at 1.7 inch pressure, and gave only 35 per cent. as much light per foot of gas burned as A. This type is fortunately more rare than the others, yet not long since I was in a church where the attempt at lighting was made with flames, many of which were as bad as this.

It is fair to assume that the wasted gas is the cause of a greater part of the complaints about big gas bills. The man has had no more light, and yet his bills are larger than a year ago, and hence he kicks.

It is unfortunate that the ordinary patron of a gas company regards his dealings with that corporation as a mystery too deep for him to fathom. Now we know that he is entirely mistaken, but to convince him of this fact is not so easy. For instance, not long since I received a telephonic invitation to call on a gentleman whose gas engine was working badly, on account of "too much air in the gas." Of course he did not believe me when I assured him the gas was all right, yet a little dirt removed from his igniter burner caused the engine to regain its normal condition, but the next time I saw him, he was as full of "air" as ever, although the engine continued to run all right,

It is to be hoped, however, that most men can be convinced of the truth of our statements by positive proof.

One of our "Down East" hustlers has been circulating among his people a neat little flyer, showing good and bad flames, with a pithy poem attached calling attention to the fact that a change from bad to good costs but a trifle. The scheme seems a good one and it is to be hoped that he will place many new burners by means of it.

We rack our brains for ways and means to lessen the cost of manufacture by a few cents, yet each additional thousand feet of gas sold, carries more to the right side of profit and loss than it cost to make the gas. So it would seem that the greatest room for improvement is in the line of extending our trade, and why is it not as proper to use every legitimate means of calling attention to a proper use of our product, as for the vender of patent medicines or ready made clothing.

Have men of intelligence and common sense on the complaint gang, and instruct them in the principles which underlie the ordinary problems of gas lighting. Let them be able to point out to the dissatisfied consumer, *why* he is not getting good service, if such is the case. Let them show the man, by perhaps putting in a larger tip, that with the same amount of gas he can get much more light, or by adjusting the pressure that he can have as much light as before, with quite a saving in the amount of gas burned. Explain to him that a closely estimated number of hours that his burners are in use, multiplied by the number of feet each burner is using per hour, will give him quite a close clue as to what his bill ought to be. The writer has used this method in several cases, and even with quarterly bills has been surprised at the accuracy of the results. On one occasion, after a change of meters, a careful calculation of the hours of burning, led to the conclusion that the meter must be about 10 per cent. fast. The meter on being tested, was found to pass just 10 per cent. more than it should have done.

Most men, while they remembered such a demonstration as this, would not only feel kindly toward the company, but would be likely to extend their use of that company's gas as their wants required, without looking about all the time for some scheme to get themselves out of the "clutches of that monopoly



Fig. 48. FLAME A.



Fig. 49. FLAME B.



Fig. 50. FLAME C.



Fig. 51. FLAME D.

of a gas company." Of course there are people who will kick from sheer depravity, and they should be treated like any other nuisance that must be patiently endured.

The days of "take it or leave it" style of selling gas are gone, and the gas manager, who will keep up with the times of to-day, and with the dividends of the past, must study the needs of his customers and cater to their demands as much as he who sells any other kind of merchandise.

APPLICATIONS OF CHEMICAL TECHNOLOGY TO GAS MANUFACTURE.

WRITTEN FOR THE AMERICAN GAS LIGHT ASSOCIATION, BY GEO. H. HARPER,
OF ALTOONA, PENN.

I have not presumed to write on this subject because of any special or peculiar knowledge I possess, or my ability to treat the matter exhaustively, or even adequately; but simply from a belief that the science of chemistry, in its relation to gas manufacture, does not receive, among the rank and file of our profession, that attention which it merits.

The birth of modern chemistry and gas manufacture may be said to have been simultaneous, both occurring in the closing years of the last century. But just as the former science has made great and rapid strides since the days of Priestly, Cavendish and Lavoiser, so are the processes of the latter radically different in their refinements from those employed by Murdoch, Clegg and Melville; the progress made in gas manufacture being but the outcome and reflection of that made by chemistry; and I believe it is true to-day that just in the proportion that we are masters of Chemical Philosophy, will we be experts in gas manufacture, in the widest and best sense. The time has gone past in gas making, as in most other large industries, when mere mechanical knowledge, however good in itself, avails a man in

making the most of himself or the business committed to his care, and he has become the "practical" man who has the keenest appreciation of the nature or properties of the raw materials he handles, and is taught by that finer perception to adopt those methods and appliances that will best develop their inherent possibilities.

A mere enumeration of the materials we handle will convince the least thoughtful of the inestimable value of chemical technology for their proper understanding and valuation. We have coal, oil, tar, ammoniacal liquor, lime, oxide of iron and gas, all compounded bodies which in their interactions give rise to many others, the nature and properties of which it is essential we should know, and to unlock the constitution of which chemistry furnishes the only key.

Of the many enigmas presented to the gas manufacturer of to-day, it is necessary only to mention a few to show how extended still is the field for research. What is tar, and can any or all of its contained hydro-carbon, be retained in a permanently gaseous form? Of what is our condenser and scrubber liquors composed, and what relationship exists between this composition and that of the crude gas, or the efficiency of condensing and scrubbing in relation to the purifying boxes and the purifying account? What are the substances entering into that complex substance we, in our ignorance, call "waste lime," and what the exact nature of the actions and interactions that have produced them? How do the practical results obtained in the use of lime agree with theoretical possibilities, and what is the precise nature and cause of loss, if any, and the remedy? What are the chemical or physical conditions best fitted to secure the maximum results from oxide of iron, and whether the highest efficiency is most dependent on a chemical or physical condition? How is efficiency affected by temperature, and what is the best temperature for any given condition of working? What are the constituents of our gas that most contribute to its luminosity, and how can the maximum of these be produced and retained?

I venture to say that the man who will thus intelligently question his apparatus and materials will acquire a higher and finer conception of, and deeper interest in, his chosen profession.

Let me select as the first illustration of the uses of chemical technology in our business, coal, the commonest as well as the most important material in a gas works.

Every coal placed upon the market is not suitable for gas making; we have, therefore, to make a selection. On what principle are we to do it? Evidently we cannot test practically every coal that may be offered us; that would be as foolish as disastrous. Yet how often do we find that certain kinds of coal are preferred to certain others after years of just such practical testing, when a little technical knowledge would have demonstrated at the start that those finally selected were the best.

I am aware that analyses of coal have been decried because of discrepancies among the analyses themselves, and also because of great discrepancies between many published analyses and practical results.

For the first part of the complaint, there is unfortunately, some basis of truth. This arises mainly, from lack of uniformity in methods of securing samples that are fairly representative of the coal; in the care to secure uniform conditions as to moisture; and in part also from different modes of conducting an analysis. Regarding the last part of the complaint, a wide divergence between analysis and working results does not always argue that the analysis is wrong or misleading, but that the manufacturing conditions are not such as to give results closely approximating to theoretical possibilities. It is a well known fact that the same coal will yield very different results in different works, the result being affected by size and condition of retorts, heats, exhaust, and a variety of other conditions.

An analysis of coal may be either "proximate" or "ultimate," the former giving information as to a few salient points, such as moisture, volatile matter, fixed carbon or coke, ash, and sulphur, and the latter affording complete detail as to the elementary constituents of the coal.

By means of a proximate analysis we can forecast with reasonable accuracy what amount of gas we will obtain from a given coal, the amount of coke and its quality, and also the probable cost of purification as determined on the sulphur found. An ultimate analysis, in addition to giving the foregoing information, would, by showing us the relative amounts of hydrogen

and oxygen present, enable us to approximate closely to the probable candle power.

Many things have to be considered in the selection of a coal, such as first cost, transit, yield of gas, quantity and quality of residuals, and an available market for them, and labor charges.

Having by the aid of chemistry, selected our raw materials, let us turn our thoughts for a little while to the gaseous products of its distillation, and see to what extent this science will aid us in understanding their constitution, and the best and most economical methods for their manipulation.

Coal gas as it leaves the retort is a very complicated body, containing a variety of substances which the gas manager endeavors to keep in a permanently gaseous form, accompanied by others for the elimination of which his utmost skill and care are demanded in order that the work may be done with efficiency and economy.

Owing to the many influences which are operative in affecting the constitution of coal gas as it leaves the retort, and the very different mechanical and other conditions obtaining at different works, it is impossible to give any formula that would be in any sense generally representative.

The constitution of the gas as it is delivered into the hydraulic main, having then passed beyond our control, and our objective being the very best attainable conditions in our finished product, it remains only to avoid subsequent deterioration from the methods and means employed for the removal of those ingredients in the gas regarding the necessity of the removal of which there is a general agreement.

The first point which naturally engages our attention in dealing with the crude gas, is condensation.

Condensation is effected by both chemical and mechanical means; chemical, in so far as a lowering temperature permits of the exercise of those selective affinities which exist among the elementary and compound bodies composing the gas; mechanical, to the extent that matter carried in suspension is removed by simple friction.

The gas leaves the retort at a very high temperature, but condensation begins immediately; a marked difference in temperature being observed between the ascension or stand pipes and that of the retorts.

A large part of the heavier tarry matter thus condensed out, never travels beyond the hydraulic mains, and if proper care be not exercised there may also be deposited a considerable amount of valuable light-giving matter through the absorption by the tar of certain of the heavier hydro-carbons we desire to retain in a gaseous form.

The effort to prevent this absorptive action, has given rise in modern times to the practice of removing the heavier tars practically as soon as produced, leaving the dip pipes where dips are used, sealed as far as practicable in ammoniacal liquor only.

If it be admitted that coal gas is mainly a body of marsh gas carrying in suspension certain hydro-carbons, which, by virtue of their original constitution or that acquired through the interactions of combustion, give it luminosity the following somewhat typical analysis of tar, will show the importance of avoiding the absorption just mentioned :

Carbon	77.53
Hydrogen	6.33
Nitrogen	1.03
Sulphur.....	0.61
Oxygen	14.50
	100.00

Coal tar is simply a body of condensable hydro-carbons. If, therefore, the luminous value of the gas depends on the amount and constitution of those compounds carried, a glance at the above analysis will show the practically endless series of such that may be obtained from tar by methods which the future will certainly develop, if they do not now exist.

In condensation, time is of the utmost importance ; the more gradual the cooling of the gas, the better the results obtained. Should the same ultimate temperature be attained by rapid and violent methods, as by slow and more careful methods, the almost inevitable consequence will be the liquefaction or solidification of some of the light-giving matter in the gas, which it should be our aim to maintain in a gaseous condition. I need only mention that "thorn in the flesh," naphthaline, to impress the necessity for care at this point.

Condensation, it seems to me, offers a rich and wide field for cultivation by means of systematic analysis of the gas at its various stages, and the intelligent and persistent use of thermometers. The data thus collected would be invaluable for comparison with that obtained from other points in our operations to show the effects of changing conditions and the relative values of different methods of working.

In scrubbing and washing, success depends absolutely on the free exercise of selective chemical affinities and the varying degrees of solubility in water of the compounds so formed, or the absorptive action they mutually exert upon each other. Here, too, temperature plays a conspicuous part, accelerating or retarding the interaction of the molecules and affecting the solubility of the gases formed in the solvent employed.

So far, our operations have relieved us of all tarry vapors, and practically the whole of the ammonia, while the other impurities have been reduced to a limit as low, presumably, as ordinary apparatus used in the ordinary way can reduce them; and we arrive now at the principal part of our purifying plant and will consider the work of the lime and oxide boxes.

This is the point, speaking generally, to which our chief efforts are directed in order to secure the maximum results in purification with the minimum expenditure in labor and materials. I will, therefore, with your permission, give somewhat closer attention to this department, reviewing the commonly accepted reactions in detail, and dealing with the lime boxes first.

When gas first enters a lime box there is a simultaneous formation of carbonate and sulphide of calcium, and these compounds continue to be formed until all the calcium in the lime has entered into chemical combination in one or other of the above forms.

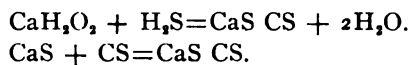
While the above is true, theoretically, we know that in actual practice the lime is never wholly used up. This arises, mainly, from two causes, a failure to secure in preparation, just that degree of moisture and general fitness of condition to realize the highest result, and also that the methods of purification in general use compel us to remove the lime when our boxes show a foul test, regardless of whether the lime has been completely saturated or not.

When CO_2 and H_2S have been absorbed until the seeming saturation point has been reached, conditions change, and the stronger affinity of slacked lime for CO_2 than H_2S comes into play, the CO_2 displacing the H_2S and allowing it to pass off in the free condition, as shown by the following equation :



Slacked lime will free the gas completely from CO_2 and H_2S , but has no effect whatever on the bisulphide of carbon.

No chemical affinity exists between lime as calcium hydrate and the bisulphide impurity, but as the hydrate becomes, by the continued absorption of sulphuretted hydrogen, converted into calcium sulphide, then chemical action takes place between the sulphide and the impurity in question, thus :



In other words, "foul lime," as we are accustomed to call it, does what clean lime will not do.

This may appear strange at first sight, but is not more really so, when regarded chemically, than that CO is highly inflammable gas, whereas CO_2 , containing but one more atom of oxygen, is neither combustible nor a supporter of combustion. The two compounds of calcium we are considering, are as radically different in their nature and properties as are the two carbon compounds.

Considerable stress is, ordinarily, laid upon this ability of foul lime to absorb CS , and elaborate arrangements of boxes have been advocated or employed to take advantage of it, often without a full and clear appreciation of the facts.

CS is known as the mono-sulphide of calcium, and we have been taught that only when in this condition does it have the power to absorb bisulphide of carbon. That is to say, the higher or poly-sulphides have no affinity whatever for the bisulphide impurity; or if they have, it is of such an utterly feeble and unreliable nature as to preclude any dependence being placed on it.

Within recent years some modification of this opinion or theory has taken place, and to-day there are in operation pro-

cesses which depend for their success on the power of polysulphides to absorb the bisulphide of carbon impurity.

Very considerable light has been shed on this question by the researches of Hood and Solamon in England.

Their experiments show that, while the common result of passing gas through a lime box is the simultaneous formation of carbonate, theo-carbonate, and sulphate of lime, heat is a very important factor in promoting and modifying the formation of all three.

This influence of heat is made manifest by the result obtained from passing CO_2 into a hot or cold solution of lime. The resulting compounds, while alike in their chemical constitution, are totally unlike in their chemical activities.

The same is true of sulphide of lime; great differences in results being apparent according as the sulphide has been prepared from a hot or a cold solution.

The rate and completeness of the evolution of H_2S from sulphide of lime by the introduction of CO_2 depends entirely upon the temperature at which the sulphide has been prepared and maintained. If cold, the expulsion is slow and incomplete; if hot, rapid and thorough, leaving in the latter case pure carbonate of lime.

Another result of these experiments was to show that the relative values of the two compounds, prepared in the manner indicated, for the absorption of the bisulphide impurity was 30 per cent. higher in that prepared from the hot solution than the other; and further, that a sulphide box once chilled, never regains its former efficiency by about 50 per cent.

In this same connection may be mentioned the well known fact that if enough H_2S has been passed through a lime box to produce the monosulphide only the absorption of CS is very feeble.

Let this same material, however, be taken from the box and exposed to the atmosphere and it is found to have a much stronger affinity for the bisulphide impurity than before.

That a chemical change has taken place in its constitution is made evident by its change of color and its deportment with reagents before and after oxidation, giving, with a salt of lead, a black precipitate in the former, and a red crystalline deposit in the latter case,

The feeble action of the monosulphide may be due, in part, to small volumes of air drawn through defective joints or open retorts by the exhausters ; as well as a slight excess of air, where air is employed for the continuous revivification of oxide, which, finding its way to the special sulphide box beyond, leads to the formation of hyposulphites, which Messrs. Hood and Solamon have demonstrated are useless for the elimination of bisulphide of carbon.

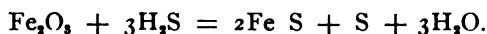
When lime alone is used for purification, with the ordinary arrangement of boxes, the best theoretical conditions are difficult if not impossible of attainment. In the majority of cases the frequent changes necessary do not give sufficient duration of contact for the development of maximum chemical action. This being further complicated by the continued disturbing action of carbonic acid.

Oxide of iron will now engage our attention for a little.

Oxide of iron, as commonly used in gas works, is either natural, dug from the earth, where it abounds in certain districts as an ore, or is artificially prepared. In the former condition it is invariably accompanied by a greater or less amount of earthy matter, which is inert and useless for the purpose of purification ; although, to some extent, playing the same part as does shavings or sawdust in the artificial product.

Oxide of iron is valueless for the removal of ammonia, carbonic acid and bisulphide of carbon ; sulphuretted hydrogen being the only impurity for which it exhibits any affinity.

The reaction between oxide of iron and H_2S is shown by the following equation :



The products being ferrous sulphide, free sulphur and water.

The deposition of free sulphur, as shown, is all that prevents the continued use of the same parcel of oxide for an indefinite period ; but a time arrives when this aggregation of sulphur bears such relation to the mass that the necessity for changing boxes becomes more and more frequent, making further use of the oxide uneconomical.

By very ordinary methods of working good oxide can be charged with from 40 to 50 per cent. of free sulphur before

being finally rejected ; and is rejected only to become the raw material of another industry. With certain modern systems of using oxide the mass may be worked up to contain from 80 to 90 per cent. of sulphur.

In ordinary practice oxide is removed from the boxes for the purpose of being "revived." This reviving consists in the absorption of oxygen from the atmosphere and the reconversion of the sulphide of iron into oxide, thus :



The sulphur thus set free remains in the mass, but only as part of a mechanical mixture, and is not chemically combined.

In Britain and certain parts of the Continent of Europe the spent oxide is a marketable article to the gas companies on account of its contained sulphur, which is extracted for the manufacture of sulphuric acid.

While the deposition of free sulphur above referred to, impairs and ultimately renders the oxide useless for our special purpose, it helps, although in a very limited and uncertain way, in the removal of bisulphide of carbon as well as sulphuretted hydrogen.

That there is an affinity, although a weak one, between free sulphur and bisulphide of carbon can be shown by charging gas, which has been already freed from CO_2 and H_2S , with vapor of bisulphide and passing it directly through solid sulphur, when the bisulphide will be found to have been absorbed.

This action is as much a source of danger as profit, however, owing to the very feeble nature of union ; the instability of the compounds formed making their decomposition extremely probable, with evolution of H_2S .

Until recently it has been the commonly accepted theory regarding oxide of iron that the hydrated oxide only was of any use in gas purification, and that the anhydrous variety was entirely non-effective.

While some few have been bold enough to question the truth of this statement, it is but very recently that Mr. John T. Sheard of England has, by a series of carefully conducted experiments, demonstrated that the purifying values of hydrated and anhydrous oxides are practically alike, differences in results

being attributable to differences of physical or molecular condition rather than chemical constitution.

With oxide purification, as with lime, it has been demonstrated that temperature is of the utmost importance, but the best temperature for any given or general set of conditions is still a matter of conjecture.

The absorption of H_2S and other compounds, by either lime or oxide, is a distinctly chemical action, and, since the intensity of such action is invariably increased by increasing temperatures, it would seem that the question of temperatures obtaining in our purifying operations presents a fruitful field for painstaking research.

MnO_2 , commonly known as "Weldon Mud," has come to the front in the last year or so as a purifying agent.

This oxide of manganese is a by-product in the generation of chlorine for the manufacture of bleaching powder; and is but another illustration of nature's economy in making the by-products, or waste products, of one industry the raw materials or essentials for some others.

Weldon mud, like oxide of iron, is susceptible of long continued use by admitting with the gas a regulated quantity of air, and complete revivification by exposure to the atmosphere.

It is claimed for this new purifying agent that it is more economical in use than oxide of iron or lime.

In one of the largest of the English works it has entirely superseded lime, in spite of the fact that they are operating under very strict legislation as to impurities.

Some of the experiments carried on at the works referred to demonstrated that for the purification of 100 million Cft 503 yards of oxide had to be shifted, as against 50 yards of Weldon mud.

Another point in its favor is the fact that however long in use it does not give rise to any inconvenience from back pressure, the pressure appearing to diminish with age.

We have now traversed the whole range of operations in the manufacture of coal gas; beginning with the raw materials in the retort and following the products of its distillation through the successive stages of condensation, scrubbing and purification, I have tried to explain and describe the methods of

manufacture in common use, the chemical reaction taking place in the various parts of the apparatus employed, and the reasons for the adoption of certain modes of manipulation and the rejection of certain others. My object has been to show how dependent we are on chemical technology for a clear understanding of the actions and interactions at each succeeding stage of our operations, and that, possessed of this technological knowledge, even in a limited degree, the production of illuminating gas acquires for us an absorbing interest.

While it is true that by chemical technology alone are we enabled to understand the various results obtained, it is not less true that by the same art we are able, largely, to control these results, as it places in our hands a reliable means of acquiring a thorough and systematic knowledge of each step in our progress.

Is it not at least probable that systematic analysis of our liquor and gas, from the hydraulic main on, determining the amount of free and combined ammonia, with the basic acids, and the amounts of the several impurities still contained in the gas, may lead us to improved methods of purification, or to anticipate the results to be obtained from any given set of conditions? Such analysis, combined with accurate records of temperature, pressure and rate of flow would, in my opinion, give ample return for the time spent.

Another matter largely affecting control of results is the quality of our purifying materials

The value of a bushel of lime to the gas maker is not because it contains a definite quantity of material, but because of the amount of real calcium oxide or quick lime which it contains.

Commercial limes invariably contain a greater or less amount of matter which is inert or useless for gas purification, such as silica, alumina, sulphate of calcium and magnesium.

Natural limestone is an impure carbonate; and the amount of oxide of lime obtained by burning will be affected in proportion as the burning and subsequent treatment has been good or bad. If improperly burned a large amount of undecomposed carbonate is the result—a material of no value for our purposes.

A moment's reflection on the first cost of lime and the labor in handling will make it apparent that an error here—when a

choice is possible—may lead to a serious increase of the holder cost of our gas.

Much the same thing is true of oxide of iron as of lime; it is only the real ferric oxide that is of any use to us.

Here again chemistry supplies us with an unerring means of determining what is good and what is bad among the materials offered us in a much more expeditious and satisfactory manner than by spending money and time in continued and disappointing experiments on a practical scale.

Speaking generally of the applications of chemical technology to gas making, I think it is of the highest importance that we rid our minds of any idea that we have reached finality; for if we do not we will deceive ourselves and impair our individual usefulness.

Gas lighting was introduced in the very early years of the present century; but more radical improvements—whether we look to the cheapening of production or the development of the latent qualities of the product—have been brought forward during the last fifteen or twenty years than in all the previous history of the industry; and to-day the master minds in our profession are reaching out to still higher attainments.

In illustration of this proposition it may not be inopportune to review shortly some of the more important changes, viewed from a chemical standpoint, that have come to the front in recent years.

I would first mention the Dinsmore system of gas making, which furnishes a partial answer to the question whether or no any or all of the hydrocarbons in tar can be retained in a permanently gaseous form.

While the possibility of converting tar into a permanent luminous gas has been demonstrated, experience with the system has been too limited to give any basis for prophecy as to its future.

Somewhat analogous to the Dinsmore system with its semi-fractional carbonization of tar, is the now almost famous "Peebles" process for the manufacture of oil gas, which is being so extensively adopted in Scotland for enrichment.

This process consists in the carbonization of oil in the retorts in the ordinary manner, washing the evolved gas in oil, which

in turn flows to the retort for carbonization. This oil washing removes certain of the condensable hydrocarbons, which are returned to the retorts for conversion into permanent gas, instead of, as in the ordinary system, flowing from the hydraulic main to the tar well.

The results from this method are a quantity of dense, hard coke and a gas of very high candle power, so permanent that it can be subjected to a temperature far below freezing without loss of bulk or luminosity.

It is universally admitted that ideal purification is that which can be wholly carried on in closed vessels, and in pursuance of this idea several systems have within recent years been developed and practiced.

A rough classification of the several systems may be made by describing them as the dry and wet ways, there being in each classification rival methods which may conveniently be grouped together for consideration.

The practice of mixing with the gas, where oxide purification is in use, a quantity of air proportioned to the amount of H_2S in the foul gas, has become very common within recent years; and it is needless that I should take up time by explaining the reason underlying the practice.

Objections have been made to the introduction of air in this way because of its well-known tendency to destroy the candle power. The introduction of air into an oxide box, however, is not analogous to admitting it into purified gas. If the amount of air is proportioned to the volume of impurity to be dealt with, then the oxygen of the air so admitted is entirely absorbed by the oxide and the inert nitrogen only is left to pass on with the gas.

In order to avoid any deterioration of illuminating power from this source, Mr. Hawkins devised his carburetted air process. This is simply the ordinary air process with the exception that the air, prior to admixture with the gas, is passed over tar heated to a temperature of about 170° F. By this means a considerable quantity of the vapors of the light and intermediate oils are carried in suspension or positively assimilated by the gas, and the candle power maintained.

The other process in the dry way to which I would invite attention may be described as Valon's Oxygen Process.

The primary idea underlying this, as the other methods, is the revivification of the purifying agent in the box, with this difference, that pure oxygen gas is used instead of common or carburetted air.

It is claimed for this system that the use of oxygen gives a slightly increased candle power, but whether this generally admitted increase of luminosity is due to oxidation of existing hydrocarbons, or simply that the higher temperature obtaining in the boxes, owing to the greater chemical activity of pure oxygen, prevents the deposition of illuminants, which in ordinary circumstances would be condensed, is still undetermined.

The oxygen process has the distinct advantage of being applicable to either lime or oxide.

The compounds formed by the introduction of oxygen into a lime purifier have not, so far, been clearly defined, but enough is known to show that there is a simultaneous absorption of CO_2 , H_2S and CS , and that the sulphur combined as H_2S or CS is not displaced by any subsequent passage of CO_2 . This is proved by the fact that when all the lime has entered into combination CO_2 & H_2S remain constant, the same amounts being found at the outlets as at the inlets of the boxes.

Whatever be the exact chemical structure of the compounds formed, one thing at least is certain that complete control of sulphur compounds other than H_2S is obtained; 6 to 8 grains per 100 feet being easily maintained. This low figure would seem to indicate the complete absorption of bisulphide of carbon as well as H_2S , leaving only those compounds of sulphur with which no known process is capable of dealing.

Sulphur is deposited in the mass in an uncombined state and is reclaimable as in the case of oxide.

The advantages claimed for this, as compared with any simple air process, are greater certainly regarding "sulphur"; the complete purification of gas by means of lime only; that the lime when removed from the box is perfectly innocuous; that only about one-half the usual quantity of lime is required, owing to the greater chemical activity, and that the purifying area can be reduced about 50 per cent.

The successful commercial application of this system depends on the production of pure oxygen at a price that will warrant its use in preference to air.

Oxygen for this purpose is presently obtained by the alternate oxidation and reduction of barium oxide. The oxide is heated in specially constructed retorts, and on being raised to a high temperature evolves oxygen previously absorbed by the passage over it of common air when at a low temperature.

Our common air being but a mechanical mixture of oxygen and nitrogen gases, it is somewhat difficult to see why oxygen obtained by the direct admission of air should not do the same work, with either lime or oxide, as that obtained by any special means. I think the very near future will satisfactorily solve this problem. The methods just outlined, while not strictly purification in closed vessels, yet so reduce the materials and labor, as well as lengthen the lifetime of the boxes, that they are rightly considered as long steps towards the desired goal.

We come now to the last class, or wet way. In this classification we have two processes, in speaking of either of which it is difficult to say whether their utility or beauty is most to be admired. I refer to Claus and Young's methods for the complete purification of gas by means of ammonia. These methods do indeed accomplish the purification of gas in closed vessels in the strictest sense of that phrase, and that, too, wholly by its own impurities, and we soar at once from the time-honored and noisome lime heap to chemically precipitated sulphur, containing over 99 per cent. of the pure element, without a trace of arsenic, carbonate of ammonia, and Prussian blue or sulphocyanide of copper, as by-products of our purification. As is the case of many other revolutions in industry, this is not the product of one brain but the outcome of the cumulative thought of many minds.

Time will not permit of my giving any detailed description of those processes. I shall, therefore, attempt only a general outline, which I trust will be sufficiently lucid to give a moderately correct impression as to what they consist of.

By Claus's process purification is carried on in a number of towers variously designated scrubbing, carbonating, heating, and distilling towers. The process depends for success on securing a sufficient quantity of ammonia in a gaseous condition to act upon the acid impurities in the gas. This is obtained from the heating and distilling towers by taking advantage in

the former of the greater solubility of ammonia than CO_2 or H_2S ; such temperature being maintained as will decompose the carbonates and sulphides with the minimum loss of ammonia. The ammonia is set free from the hydrate so formed by means of steam coils in the distilling towers. The free ammonia is then passed into the scrubbers, flowing in a direction opposite to that of the gas. The ammonia in its passage through the scrubbers combines with the CO_2 and H_2S , and the gradually strengthening liquor is pumped from tower to tower until practically saturation is obtained. The foul liquor passes thence to the carbonating towers, where it meets and mingles with the acid gases coming over from the heating towers already referred to. The sulphides in the liquor are here broken up by virtue of the stronger affinity of ammonia for CO_2 than for H_2S . The liberated H_2S passes on to the sulphur recovery apparatus, afterward described, and the excess of CO_2 is removed as solid carbonate of ammonia. The subsequent operations are the heating and distillation already described. Care is taken by means of catch towers that no ammonia is carried off, and the acid gases from the carbonating and heating towers are carried to a kiln, which may be described as a tube packed with oxide of iron maintained at a red heat. A regulated quantity of air is admitted, and the mixed gases and free sulphur vapor are carried forward to a condensing chamber, where the sulphur solidifies. For the removal of bisulphide of carbon the weak liquor from one of the scrubbers is brought in contact with solid sulphur from the kiln, in this way forming polysulphides, which are found to be effectual for the removal of the impurity in question.

You will remember when speaking of the action of polysulphides in the dry way, it was stated that their action was feeble and unreliable; yet here is a process which depends for success on this very action, and these higher sulphides are found sufficiently stable to do the work.

The spent liquors from the distilling towers contain appreciable quantities of ammonia. This is driven off by means of caustic soda or lime, and the liberated gas returned to the distilling tower. If to the remaining solution a salt of iron or

copper be added the resulting precipitate will be ferro-cyanide of potash (Prussian blue) or sulpho-cyanide of copper.

In Young's process the underlying principle is the same as in that just described ; the chief point of difference being in the method of removing bisulphide of carbon. Mr. Young proposes to accomplish this by means of pure hydrocarbons, preferably naphtha, the first distillate of coal tar. Naphtha contains a series of hydrocarbons strictly analogous to those in the gas, where both have been produced from the same coal ; and Mr. Young's theory is based upon the fact that the quality of the tar from any given coal will be reflected in that of the gas. In other words, if the gas be rich in any given series of hydrocarbons the tar will be rich in the same series. He has found that if gas be passed over naphtha it will absorb hydrocarbons from the naphtha until saturation is attained, but if a portion of the heavy oils from the tar be mixed with naphtha there is no such absorbing action ; a complete balance being maintained between the gas and naphtha. If, now, some one or other of the hydrocarbons in the naphtha be removed the denuded naphtha will absorb from the gas the hydrocarbon of which itself has been deprived ; and this action will continue until a balance is again restored. His plan is, then, to free naphtha from its organic sulphur compounds, then expose it, mixed with heavy oils, to the gas, when the organic sulphur compounds in the gas will be absorbed.

The two methods thus roughly described are beautiful conceptions and distinctly within the lines of applied science. They both effect the complete purification of gas in closed vessels, with little labor, and an entire immunity from nuisance of any kind. They both free the gas completely from CO_2 and H_2S , and accomplish a reduction of other sulphur compounds to that limit beyond which our present knowledge does not extend.

Did not the title of this paper confine me to manufacturing operations, I might go on indefinitely enumerating points of interest, such as the relative values of hydro-carbons as illuminants, the modes of their formation and their action in combustion ; the reduction of candle power by carbonic acid ; the causes underlying the formation of naphthaline ; the deposition

of sulphur compounds by naphthaline ; the principle, practice, and prospects of incandescent gas lighting : the light-giving matter in a gas flame, and its behavior according to the recent brilliant researches of Prof. Lewes, not to speak of innumerable questions relative to our secondary products and their uses, but time forbids.

Much of what I have said, it may be alleged, applies especially to coal gas. It is true. Let me remind you, however, that the essential difference between coal gas and water gas, is in the method of manufacture only, and nothing has been said specially applicable to coal gas and the inestimable value of chemistry to its thorough understanding, that may not, with equal force, be applied to water gas. It may be, perhaps, that the raw materials are not of such vital importance in the latter as in the former case, but there is still a wide and varied field for careful and systematic cultivation. When, in the manufacture of water gas, our finished product can be so easily affected by the duration of runs and blows, the quantity and condition of steam, the quality of the coke or coal used in our generators, the specific gravity and constitution of our oils, the temperature and general conditions under which we operate, and the relative amounts of impurities in our crude gas, it will be evident there is no lack of scope for the best energies of each of us.

In conclusion, let me state that I have brought forward nothing new or original ; nothing but what, doubtless, is well known to most of you. I have tried to cover, however imperfectly, those points that confront us in our daily practice, for the proper and intelligent understanding of which chemical knowledge is essential, in the hope that by thus grouping them and showing their almost infinite range, a spirit of inquiry and research may be aroused. Let us not be discouraged by failure in any experiment or set of experiments. Proficiency can come only by practice and careful attention to detail. There is no royal road to chemical knowledge and expert analysis, they are to be acquired only by patient persevering toil.

There is nothing in the study of chemical science that need dismay any man who starts out with the determination to succeed. Let us each in his place remember that he is the representative of a business almost universal in its scope and in-

terests, and that a corner of the vineyard has been committed to his care. It is surely our reasonable service, then, to see to it that, if we cannot increase the sum of knowledge, that available is not allowed to become meaningless jargon to us from lack of interest.

I do not wish to advise any course of reading or study covering the whole realm of chemical philosophy, nor do I wish to deter any one from undertaking such. The more we read and assimilate, the better rewarded we will feel for our trouble. We are busy men, however, and failing the wider knowledge let us strive to grasp and master that which lies to our hand pertaining to every day duties. A few books well selected and carefully studied, if productive of no other result, would, at least, widen our field of thought and observation. In this connection permit me to urge that we keep ourselves fully abreast of the current thought and practice of our profession as set forth from week to week in the technical journals. I do not insist on this from the low standpoint of mere duty, but because, if neglected, a great amount of knowledge which is useful, interesting, and even essential will be missed; knowledge which to be without, argues something approaching indifference.

In these days when such great versatility is demanded of men, a successful all-round gas engineer is a compound hard to analyze and resolve into his essential elements; but let us not forget that gas manufacture, from the initial to the final state, is a distinctly chemical operation, and the more intimate our knowledge of the science of chemistry the more absorbingly interesting will our daily work become, the more vigilant will be our care that we are securing these results which modern research has shown possible, and the higher will be the place occupied by gas manufacture and its representatives among the world's industries.

SUPPLEMENT TO OBSERVATIONS ON SUNDRY METHODS OF MAKING WATER GAS FROM BITU- MINOUS COAL.

WRITTEN FOR THE AMERICAN GAS LIGHT ASSOCIATION, BY FREDERIC EGNER,
NORFOLK, VA.

Having received a number of inquiries upon subjects treated in the article published under above caption, it has occurred to the writer that additional information would be desirable at this time. It is to be hoped that the members of the Association will not be backward in supplementing or correcting matter, which the writer has had the honor to place before them. For instance, one of the processes mentioned, was in what the author would consider merely the experimental stage, when inspected by him. Although *that* would not excuse the unfounded claims made by its promoters at that time, it may have been greatly improved since, and if so, it surely must interest all progressive gas men to know the real facts as they now may appear.

The writer has tabulated the figures quoted in the body of the first paper under discussion, and added for comparison known results obtained with other apparatus for the production of illuminating water gas. No. 1 was as described on page 66, No. 1, Vol. XI, of our published proceedings, operated only a portion of each day. Had it been run to its full capacity, the results must have been very materially improved. We have been informed that some apparatus of the type in question, produces a thousand cubic feet of gas with less than 28 pounds of coal in the generator, and the author designed a large apparatus more than eleven years ago, which required less than 30 pounds per thousand cubic feet. The figures given in the table, should not therefore be regarded as intended to be a standard or criterion of the performance of the apparatus named, but simply

a statement of results which came within the author's personal experience.

Reference No.	Name of Apparatus.	Kind of Fuel used in Apparatus.	Pounds of fuel used per 1000, exclusive of steam.	Gallons of oil (Naphtha) used for 1000 c. ft.	Gallons of crude oil used per 1000 cubic feet	Candle power of the gas.	Cubic feet of Gas made per man employed at apparatus each day's work.	Remarks.
1	Improved Lowe	Anthracite.	40.2	4 67	....	24.0	75,000	Work Intermit-
2	Granger-Collins	"	40.3	4.57	....	20 0	75,000	tent..... Work Intermit-
3	Springer	Anthracite.	39.9	5.29	....	18 4	120,000	Year's average.
4	Pratt & Ryan ...	Anthracite	42.6	4.89	....	19.0	120,000	" "
5	Egner	and coke.	31.0	0.75	3.51	20 8	87,585	" "
6	Flannery	Gas coke..	42.9	5.00	....	26.0	180,000	" "
7	Rose	Anthracite.	91.5	4.18	....	24 0	Not known	Experimentally
8	Loomis	Gas coal ..	44 8	....	....	25 0	81,500	Regular aver-
9	Rew	Semi - bitu-	36 0	....	4.31	25.0	66,600	age
10	Rew	minous..	48.0	....	4 36	26.0	66,600	Average to date
11	Jerzmanowski ...	Youghio- gheny... Du Quoin Not	7.00	2.85	27.0	150,000	150,000	" " Year's average.
		Crude Oil.	Crud					

No. 2, was obtained from the averages of an apparatus erected twelve years ago, operated almost constantly for eleven years, and which is still in good order.

Nos. 3 and 4, are averages of a year's work, during which a good deal more than 300,000,000 cubic feet of gas were made by both styles of the apparatus named.

No. 5, is the average of one year's work, as mentioned on pages 59 and 60, current volume of the "Proceedings."

No. 6, is the average of a number of months' operations on a large scale.

Nos. 8, 9 and 10, have been extensively referred to in the text of the July number of the Association "Quarterly." Since the publication of the July number or the "Proceedings," some inquiries relative to the process described, were received by the

writer, who, however, can add but little to the information previously published, hoping, as he trusts others may, that further and desirable facts bearing upon these matters, may come before the Association at the coming meeting. A question about the nature of the fuel gas produced in connection with No. 10, can be answered by the author, only to the extent that he was assured that from 17,000 to 19,000 cubic feet per hour, of same, was required in the carbonizing retorts, which ordinarily consumed about 56 bushels of gas coke in 24 hours to do nearly the same work. In an analogous process of gas making, the author found that 8 pounds of coke were consumed per thousand cubic feet of gas carbureted in the retort benches.

Of course, had any one of the improved retort furnaces been used, instead of the old fashioned one which *was* used, less fuel per thousand would have been the result.

In comparing results, it should always be remembered that the gas maker, the man who handles the valves, is an important factor with any process. With No. 1, for instance, it was found that one operator used upon an average, one gallon of oil less per thousand cubic feet of equal quality of gas, than another did. It was only after weeks of careful instruction and effort on part of the man himself, that he was finally able to do as well as the first man did. It is a mistake often made, to suppose that the great apparent simplicity of making water gas, makes it therefore possible to employ as gas maker, any sort of a man who can jerk a valve up or down, or has just sense enough to turn on and off steam and oil every set number of minutes, and whose principal qualification is, that he can be had very *very* cheaply. *It is a costly mistake, invariably, to the company,* as every one who has made gas making really a study, knows. The quantity of coal required to produce the necessary steam has not been touched upon in this article, because the amount of steam required varies but little in any process, and because the manner of its production has nearly everything to do with it, if that item of water gas manufacture costs much or little. The fuel actually required, ranges all the way from less than six to over twenty pounds per thousand cubic feet of gas made. Here, as in generator work, much depends on the good sense of the fireman, and general intelligence of the manager of the appa-

ratus. Twelve pounds per thousand would seem to be the average, but is by no means good work ; besides, as you all must know, the style of boiler cuts an important figure as to the economy of fuel needed to raise steam.

And now, in closing my paper, I desire to say that the author is not unconscious of the censure administered frequently to one who ventures, generally with the best of intentions, to write for publication professionally, or as we do in our Association papers, as contributors to our proceedings. It is not a difficult matter, *not to write*, and the writer is aware that he may often be found fault with, for doing what must be done by some one, if we are to continue to have profitable meetings.

THE USE OF GAS FOR OTHER PURPOSES THAN LIGHTING.

WRITTEN FOR THE AMERICAN GAS LIGHT ASSOCIATION BY BURDETT LOOMIS,
OF HARTFORD, CONN.

The time has arrived when Gas Companies must look for their increased output to the gas used for other purposes than lighting. Enough has been accomplished in this direction to warrant vigorous work on the part of officers of companies to enlarge their field of usefulness and profit.

The possibilities in this direction are so vast and varied, and their full realization would result in such a great change from existing conditions that it confuses even those well versed in the present methods of manufacture and distribution of gas for lighting purposes.

There is a difference of opinion as to whether gas will ever entirely replace coal for heating and power purposes ; also as to the quality of gas that it is best to furnish, for it will not be long before at least one-half of the output used will be for purposes where its value will be rated by heat units instead of candle power.

While there are points that are debatable, and need further practical demonstration, there are many important uses where gas as fuel has proved its utility and economy, and it needs but vigorous and intelligent work on the part of those interested to greatly extend its use. You have a very valuable franchise that gives you a carrier that delivers gas to every house on your line of mains. For lighting purposes it is used but about six hours per day, and with but little, if any increase, it will supply enough for cooking, small powers using gas engines and light heating.

As for cooking by gas, there remains little to be said, but much to be done. As good appliances are in the market as could be asked for, and they cover the entire field from the complete kitchen equipment of large hotels where the broilers do "to a turn" two thousand pounds of steaks and chops daily down to the little burners that are slipped over an ordinary tip to warm a cup of water.

The manufacturers of these appliances are doing even more than the companies to introduce them. Every company should have an organized department to attend to this part of their business, and a thorough canvass should be made of every house, and every possible customer induced to use gas for cooking, and if they will not, their reasons should be recorded and means taken to overcome their objections. All branches of trade now seek their customers, and the waiting policy is disastrous.

The coal, oil and gasolene agents are active, and can be met only by like solicitation on the part of gas managers.

GAS ENGINES.

The Gas Engine has been ably presented to this association in a recent paper by Mr. F. H. Shelton*, and in summing up he says:

First—"That as Engines they are all right."

Second—"That compared with other motors they are equally good, and that they can hold their own, if properly pushed and sold."

* See Proceedings, Vol. X., No. 2, Page 251.

Third—"That while in the past the fault has largely been due to the price of the engines, this will be bettered in the near future, through the newer makes appearing."

Fourth—"That the gas man has been at fault, and part of the betterment of condition must come from his greater push of engines than heretofore."

Thus it appears there are two good reasons why gas engines are not more generally used.

First—Lack of push on the part of the gas men.

Second—High prices for engines.

A five H. P. gas engine sells for about \$450, or \$90 per H. P. The interest on the investment at 6 per cent. is \$5.40 per H. P. per annum. This engine running full power 10 hours per day for 300 days, using 25 cubic feet per H. P. per hour, would use 75,000 cubic feet per H. P. per annum. A reduction of 8c. per M. cubic feet would pay 6 per cent. on the entire cost of the engine. A 25 H. P. gas engine sells for about \$1250, or \$50 per H. P. Interest at 6 per cent., \$3 per H. P. per annum. This engine, running 10 hours per day 300 days, issuing 20 feet per H. P. per hour would use 60,000 cubic feet of gas per annum per H. P. A reduction in this case of 5c. per M. cubic feet would pay 6 per cent. interest on entire cost of engine.

Is there not profit enough on gas sold for gas engine work to meet this question of high-priced engines at once, rather than wait for time and tide to wear the price down while the other fellow is getting the business? Is it not possible that lack of business enterprise is causing all the trouble?

The gas engine produces more power per pound of coal than any other power generator. It rests with the managers of gas companies as to whether they will furnish the gas, or allow the gasolene on small plants with the engine to do the business.

MECHANICAL AND MISCELLANEOUS.

It would take too much time and space to comment on each of the thousand and one uses to which gas is and can be put to under this head, but the following list may be of benefit in looking up new business :

Melting metals,	Keramic kilns,	Heating hat blocks,
Brazing,	Heating rivets,	Roasting coffee,

Soldering,	Enamelling ovens,	Heating laundry irons,
Tempering,	Drying ovens,	Heating tailors' irons,
Annealing,	Glass Blowing,	Confectioners' stoves,
Light welding,	Light Forging,	
Firing colors on glass, etc., etc., etc.		

Heating by gas opens a wider field and is a more complex problem. What can be done under existing conditions with gas at present prices? With gas having 650 H. U. per cubic foot, \$1.00 per M., and anthracite coal having 14,000 H. U. per pound at \$6.00 per 2000 pounds.

28,000,000 units in 2000 pounds of coal cost	\$ 6.00
28,000,000 " " 43,076 cubic feet of gas cost.....	43.07

Say, 7 to 1 in favor of coal on the heat unit basis.

This does not appear very encouraging, but it must be borne in mind that the above represents but the heat capital, and it is to be demonstrated how much of each can be effectively utilized. It will be interesting here to compare the heating value and costs of coal and gas for cooking. In a recent test of one day's cooking by coal and gas the following amounts of coal and gas were used :

30.68 pounds anthracite coal at \$6.00, costing .0920.
67.88 cubic feet of gas at 1.00, " .0678.

The kindling being left out. The cost of gas being about two-thirds that of coal. Had it taken as many H. U. with gas as with coal the result would have been different.

30.78 lbs. coal having 429,530 H. U. at \$6.00 per ton cost .0920.
 661 cu. ft. gas having 429,650 H. U. at \$1.00 per M. costing .661
 or 7 to 1 in favor of coal, presuming the proportion of heat utilized was no greater in the gas stove than in the coal stove. These are the figures that the pioneer in gas cooking faced and gloriously conquered.

As good a showing is not to be expected in heating, as modern coal heating appliances utilize a larger per cent. of the heat units than cooking stoves using coal, and the beginning should be made in places most favorable for gas. Small rooms that are heated but for a short time and irregularly, can be heated

by small gas fires in grates or heaters economically, and here they fill a want that coal cannot, as they can be started and shut off without trouble and act quickly. Open gas fires are giving much satisfaction in houses and offices that are already heated by the usual methods, and the cheerful glow and strong radiant heat, quickly produced when needed, the freedom from dust, with the handsome appearance of many of the later appliances, insure a steady increase in this direction.

There is a field for heating on a larger scale, using hot air, hot water, or steam heaters, in which but little has as yet been accomplished. Stores that are open but eight or ten hours daily, and where room is valuable, the basements being used for storage, where freedom from dirt and dust of coal fires is important, here hot air or hot water furnaces using gas will prove very satisfactory.

In stores in large blocks in cities, the gas can be turned off at night and started in the morning, so that it is in actual use but half the time. Many such places are now paying for steam heat from a central plant double what it would cost them to run their own heaters with coal, as this is the only way they know of getting rid of the dirt and annoyance of running their own system. A gas furnace would meet all of their requirements, and a gas hot air furnace can be put in at one-half the cost of a steam heater, and certainly will run as cheaply. Saloons and restaurants that are open until midnight, and using large quantities of gas for lighting, the lights in most cases heating their places through the evening, should heat through the day by gas. Now the gas in lighting is but adding to the income of the steam heating company.

For heating entire dwelling houses through the year, gas at \$1.00 is a luxury that those who enjoy must pay well for, but there are times and conditions when gas can be so used. Many city houses with but the front and back exposed are now equipped with two hot air furnaces, one large and one small. The latter is used during the fall and spring when but little heat is needed and that intermittently, and the small furnace is needed a few exceptionally cold days in winter. The larger furnace runs steadily through the colder part of the winter, and does the greater part of the heating. A gas hot air furnace would work

to great advantage in place of the smaller furnace. The sudden variations in temperature during autumn and spring can be met by a gas furnace, and as the volume of heat required is not great the gas consumption would be light. For the same reasons portions of the United States where the climate is mild and the temperature in winter corresponds to that of New York city during autumn and spring, affords advantages for gas heating. Gas men should post themselves on store and house heating where gas offers the greatest advantage. They should study appliances so as to know which is the best for each case. A hap-hazard selection of place and appliances will insure failure. A handsome appearance is as essential for small heating appliances as economy. Where 50 cubic feet or more of gas per hour is needed, a good gas hot air furnace or hot water heater is the most economical and effective. These furnaces will utilize not less than 90 per cent. of the available heat generated by the gas, and the popularity of these systems is established. With thermal regulator the temperature can be maintained at any desired point.

The prospect for using furnaces for heating with gas has been greatly improved by the introduction of those constructed to use gas solely for fuel, together with improved burners and regulating devices. With the best of these appliances it is now possible to utilize nearly all the sensible heat, and even part of the latent heat. The means used to accomplish this are best illustrated by a cut and description of one of these furnaces,—the “Vulcan” Gas, Hot Air and Hot Water Furnaces. Some of the features which make them superior to the ordinary coal furnace for using gas, are :

First—Large fire or heating surface in small space.

Second—Extensive application of the “drop flue” principle, thus ensuring the absorption of a large amount of heat from the products of combustion.

Third—Subjecting the products of combustion as they leave the furnace to the incoming cold air or return water. This is very important in the air heater where the difference in temperature between the incoming cold air and outgoing hot air is considerable.

Fourth—Provision for caring for the condensation from products of combustion when cooled to the condensing point.

Fifth—Construction providing for discharging the products of combustion to the open air at very low temperature.

Sixth—Burning the gas in hot brick-lined chamber ; thus ensuring complete combustion.

Seventh—In the Air Furnace the direct action of the heat on the dome insures a quick supply of warm air when lighting up and when using but little gas.

Eighth—In the Air Furnace the lining of the combustion chamber and construction of furnace prevents the overheating of any one part, so that the air is not brought in contact with red hot iron.

Ninth—The burners are arranged so that one lever controls the gas and air to mixer, and also the secondary air ; thus when the gas cock is opened or closed the air inlets also are opened

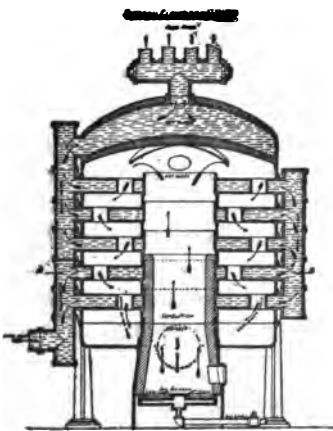


FIG. 52. HOT WATER HEATER.

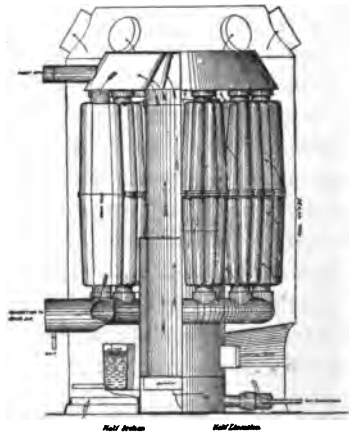


FIG. 53. HOT AIR FURNACE.

or closed in just the proportion to admit the least amount of air that will effect complete combustion. So that all the intelligence needed to regulate the furnace is to open and close a gas cock, a simple arrangement ensuring the admission of an amount of air proportionate to the gas supply. This is a very important addition to gas furnace appliances, as the highest

efficiency of a furnace can be attained only by using the least amount of air that will effect complete combustion ; thus obtaining the highest obtainable temperature at the burner and the lowest at the outlet to chimney, with the least volume of products of combustion. The average furnace attendant cannot be expected to know enough to properly adjust a burner, and as the gas furnaces will be regulated by an automatic regulator or arrangement controlling the heat, placed in the living rooms ; something of this kind is a necessity, and it also prevents lighting back.

This is not a cheap age ; on the introduction of the electric light many gas men figured and found that the electric light was more expensive than gas, and hence concluded that it must be a failure. Their figures were and are now correct, but the thousands of electric lights gleaming in every city in the world prove the fallacy of their conclusion. Does the public use gas for lighting instead of kerosene because it is cheaper ? The public want the best and are willing to pay for it a fair price. No one questions the excellence of gas for fuel purposes, and the question of cost will be ultimately solved by a reduction in the price of gas, made possible by increased consumption, cheaper methods of manufacture, improved appliances for using it, better business management and methods of distribution.

The public will pay more for a better article than coal. There are many important items of cost in the use of coal for domestic purposes that are not included in the "six dollars per ton, delivered." The many coal teams on the streets, the wear on pavements and littering of streets and walks, the daily labor and attention at the furnace, and where bituminous coal is used, the smoke nuisance with its sooty trail of costly evil. The coal dust and ashes in cellars and houses, the disposal of ashes again littering the walks and streets, and filling the air with fine particles of dust. Take the ashes from the garbage problem and it becomes much simpler. These economies and conveniences are a guarantee to the gas company of a profitable return upon the outlay required to provide a more extended and better service.

TAXATION.

1. TAXES: AUTHORITY FOR THEIR COLLECTION.
 2. TAXES: WHY EXEMPTION SHOULD BE MADE.
 3. TAXES: A MEANS OF RESTRICTING EVILS.
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BY ALLEN RIPLEY FOOTE, WASHINGTON, D. C., AUTHOR OF THE DISCUSSION OF THE ECONOMIC PRINCIPLES INVOLVED IN "THE LAW OF INCORPORATED COMPANIES OPERATING UNDER MUNICIPAL FRANCHISES."

To be read before the American Gas Light Association, at its Twenty-second Annual Meeting, Washington, D. C., October 17, 18 and 19, 1894, by request of the Secretary.

TAXES: AUTHORITY FOR THEIR COLLECTION.

1. The power of taxation is the most arbitrary power known to our civilization. The aggregate strength of those who may be termed the weaker members of society is much greater than the aggregate strength of the stronger members. Government represents the aggregate strength of the whole number of law-obeying persons. In creating a government a new power is brought into existence greater than that of any man, or set of men less than the whole of society. As the intelligence of the weak has enabled them to comprehend this fact, they have learned to take advantage of and to control this great power for their own protection. Within the limitations of governmental protection all men have found security and freedom. To-day the poorest political sovereign enjoys greater security, greater freedom, than did the hereditary princes of olden times.

2. The limitations surrounding a government organized to establish justice are the principles of the natural law of justice. This law is no respecter of person. Before it all men stand equally responsible for their own conduct. By their own acts they write the judgments of justice. The truth is self-evident,

that if no act of injustice is done by any man, no man can suffer from acts of injustice. Another truth ought to be equally self-evident to the perception of every mind. It is this: IN THE DOMAIN OF JUSTICE NO MAN CAN BE A GAINER BY HIS OWN ACTS OF INJUSTICE. We may not be able to escape suffering from the wrong doing of others,—that is not the chief concern. *We can refuse to do wrong.* In the adjustments that must be made if justice is to be done, those who suffer from wrongs done by others, will find relief and full compensation; those who do wrong will make full expiation. It is better to suffer than to do wrong. It is better to be just *now* than to fulfill the demands of justice hereafter.

3. These generalizations applied to every day affairs will institute a government, the chief concern of which will be the complete protection of its weakest member. Under its administration an injustice to one will be made the concern of all and the cause of the weak will become the cause of the whole. The oppression of the poor will not then be attempted, because to the defence of the poor will be pledged the full power of the State.

4. The fundamental right of Government to collect taxes is based first, upon the justice of the law, exacting an equal proportion from each dollar of value, and secondly, upon giving a full equivalent to the taxpayer in return. The tax is not just if it is unequal. It is not just if value received is not given in return to the taxpayer. Measured by these standards, the right of any Government to collect a tax must stand or fall. The exercise of power without authority of justice is tyranny. The collection of a tax unequally laid, or of a tax for which full value is not given in exchange, is not good business. If no man can, as a final result, be the gainer by his own unjust acts, neither can the individual nor the public welfare of the people be served to the best advantage by unjust taxation, nor can a people be made prosperous by the payment of taxes for which they do not receive full value in return.

5. These truths are plain and easily understood; there is no mystery about them. The Government to be just, must be governed and govern by the same principles that must govern each individual if he is just. The Government is unjust because it is

governed, not by the principles of natural justice, but by the principles of enacted law which applies the injustice of men.

6. These principles, simple and plain as they are, applied, will lift the burden of oppression from the poor and gladden the hearts of all men. There is no remedy for the evils from which men suffer, except in strong co-operation and right action on the part of every man. There is no outside power that can improve the situation so long as the people by voluntary act or submission permit the ignorant or vicious to rule over them. So long as men and women will work under oppressive conditions self-imposed, the conditions will continue, but when they act by counsel and resolve to establish justice by doing justice, they will need the help of no one, they will have learned how to help themselves. These questions have been difficult of solution simply because they have been taken up as questions of sentiment instead of sound business procedure. The harmonizing of the relations of employé and employer, the poor and the rich, is purely a question of practical business. Sympathy for neither, justice for both, will develop the full economic value of harmonious relations between all factors of the social problem.

7. The application of the principles of justice will not only secure the enactment of just laws, it will secure the just administration of laws. No longer will there be a corrupt use of public patronage or public funds. The servants of the public in office will be freed from the bonds of party duty as a condition for obtaining or retaining public employment, and for that reason they will be compelled to look for preferment to their records of public duty well done. Never again will honest and intelligent citizens mantle their faces with the blush of shame, caused by reading an announcement that a special train had been chartered by Government employés in Washington, to take them home to vote at the *primaries* for the nomination of a candidate for a member of Congress, of doubtful character, to whom they are indebted for their appointments. Never again will this report be made by the superintendent of the police of a great city: "A wide spread belief existing among the force that merit or the faithful performance of duty is not taken into consideration in promotions, and that *a large number of officers and men have obtained their positions through means other than meritorious service and faithful performance of duty.*"

Never again will taxpayers' money be used to pay debts created for purposes that could have been supplied at an equal economic advantage by contracts with individuals, firms, or corporations, without the creation of a debt. Never again will the press of the country be loaded down with the accounts of corruption in high and low places, nor will the poor and ignorant ever again stand in fear of the power created to protect them. When the demand for justice originates with the people, all laws governing taxation will be made just, and the authority for collecting taxes will be undisputed, because founded on justice. Government has no power to benefit the people unless the people from whom it derives its authority are honest and intelligent. It is hurtful or beneficent in proportion to the honesty and intelligence with which its laws are enacted and its powers administered. The Government cannot establish justice if the people are not just.

TAXES : WHY EXEMPTIONS SHOULD BE MADE.

1. "To promote the general welfare" is one object of government of fundamental importance. One of the most powerful agencies subject to the control of government for such purpose, is the power of taxation and the power to exempt from taxation. The protection of the right of ownership is fundamental to the existence of property. This principle being established, the next requirement is so to use the powers of government as to induce the production of property. The principle that all property shall be taxed equally is not infringed by the exemption from taxation of certain classes of property or of property devoted to certain uses. The question of such exemptions is purely a question of public policy, "to promote the general welfare" but there can be no general welfare unless it is founded on individual welfare.

2. Without passing judgment at once upon the merits of the policy of exempting property from taxation, it is necessary to affirm that all use of the power of exemption should be uniform. The power to exempt must be co-existent with the power to levy taxes. If the State has the power to make exemptions from State taxation, the municipalities and counties in the State should have a corresponding power to make exemptions from

local taxation. A large class of people contend that no exemptions should be made except for public property, and this, for the very clear reason that the Government cannot obtain an increase in net revenue by collecting taxes on its own property. If the adoption of the policy of no exemptions is found to promote the general welfare in the best known manner, there should be no objection to its complete adoption. There is another large and growing class who believe that all property should be exempt from taxation, except land. If this policy is pregnant with individual and public good, there should be no objection to its adoption or of a gradual approach to it until the ideal is fully realized. Sound financial measures are always just measures.

3. It is unquestionably good policy to encourage the cultivation of those qualities that make for good character as they induce voluntary obedience to law and thereby reduce the amount required to enforce the law. One of the fallacies met with in discussing questions pertaining to taxation, has its cause in a habit of thought which treats of the government as having a distinct existence of its own apart from that of the people. This habit of thought prevents people from seeing that every dollar used by the government has an individual origin and is resolved back in an effect upon individual welfare. Laying aside all sentiment, any person capable of thinking upon the subject impartially, must admit that all private property used for educational and religious purposes, is devoted to the work of educating persons to yield voluntary obedience to law. This service to society is enormously greater than the service rendered by the State in granting protection free of charge, to all such property. But this is not all of the consideration. Law-obeying citizens cost the government nothing for enforcing the law, therefore the tax remitted on property used for their education, is more than saved by the direct reduction in the expense of the Government. Again, law-obeying citizens are industrious and thrifty. They not only stand for protection of all property, but for the production of all property. Their energy, enterprise and thrift add to the total valuation of property to such an extent that the rate of assessment is much less on the total—less the value of all property used for educational

and religious purposes—than it would be on the valuation of all property if no private property was so used. This is a contribution to the general welfare of the highest importance. Again, the education of children is universally recognized as one of the fundamental functions of the government “to provide for the general welfare.” Wherever private property is used for educational and religious purposes, the property itself, its maintenance and all expenses for the educational and religious work done therein, is provided by private contributions. In a large measure this whole outlay is for a purpose which, if not so done, would have to be done at the expense of the State. Let any person carefully consider what it would cost the State to develop and maintain the present law-obeying status of every individual, if all work done at private expense for education and religion was abandoned. The simple suggestion is sufficient to show that the State is an enormous gainer through the slight encouragement it may give to such work by exempting the property necessary for its use from taxation. The voluntary tax paid through contributions by the supporters of such work is enormously greater than the direct tax remitted, and the remitted tax, if collected, would be in effect and in fact, the same as a tax on a court house, which would have to be included in a tax levy to pay the expenses for the administration of justice.

4. Different in kind, but not in character, are the considerations for exempting from taxation all private property used for the purposes of private charity. No word of mine has power to add new lustre to the crown of charity. Caring for the unfortunate, appeals, not to the reason, but to the heart of justice. Charity grows cold in proportion with the distance intervening between the doer and the receiver. The nerves by which human emotion and feeling are transmitted, are not delicate enough to respond with fullest sympathy and joy through long distances and many repeaters.

From every human heart these nerves reach out, and that heart is greatest from which they reach out farthest. That heart receives into itself most joy, whose tendrils of sympathy have touched with greatest delicacy and helpfulness the unfortunate for whom it was within its power to care. If the pursuit of happiness, that great fundamental constitutional right for

acquiring which the people dedicated their fortunes, their lives and their sacred honor, was rightly directed, charity would be so completely done by private means that there would be greater competition for the privilege to care for an unfortunate, than there now is for an audience with the greatest of earth. The greatest of earth, unrecognized though it may be, they really are by reason of their power to gain audience with Divinity. Listen! Do you not hear a voice speaking through the ages, as directly addressed to you as though you alone stood in the Divine presence? "In as much as ye did it unto one of the least of these, ye did it unto me." Laws have no power for good except as they find expression through conduct. Divinity has no power to care for the unfortunate, except through the conduct of those to whom the opportunity comes. Sympathy cannot live in a heart from which no deed of charity issues. Justice is the soul of sympathy.

5. Those people who relegate their charities to the State, and confine their expenses for charity to the payment of their proportionate share of a general tax, receive all appeals for the development of those influences that make for good, with a palsied hand and a dead heart. They generate none of the forces that promote the general welfare. They are workers in none of the movements for the betterment of the conditions of life; they cannot be more than legally honest; they are most damnably mean.

6. Charity is a duty that can never be fully nor well done by the State, but if it could be what an overwhelming burden would be placed upon taxpayers if the whole amount expended for private charity was added to the expenses of government and all property assessed for its proportionate share. As a thrifty policy of financiering it is unquestionably best for society to encourage private charity to the fullest limit possible through exempting from taxation all private property used for such purposes. The voluntary tax remitted is but a bagatelle of the indirect tax paid by those who support charity, and it is the least claim that can be made upon those who do no charity. By such course society gains enormously in the value of influences for good and the taxpayer gains through a tremendous decrease in public expenses.

7. Property used for private reformatories, like that used for education and charity, is used for a service of the highest importance to society and one which the State cannot do well. The State has no heart, the State has no conscience, the State has no intelligence except that of the enacted law. In the work of reformatories there is joined the factors of enforcing obedience to law, education and charity. Surely this is a work for the general welfare which is entitled to all the encouragement that the State can wisely give. Including both education and charity it adds to them discipline calculated to make obedience to law instinctive in the mind. Like other benefactions, to the degree in which the needed work is carried on by private funds public funds are relieved from a corresponding charge,—a charge immeasurably greater than the amount of the tax on the property used for such purposes.

8. It is clearly seen that the State cannot increase its net revenue by levying taxes on property owned by the State. It should not be less difficult to see that the State must inevitably lose more than it can gain by levying taxes on property used for private education and religion, for private charities, and for private reformatories. All of this work as done tends directly to cultivate honesty, industry and thrift, the creators of property, and thereby to reduce the rate per cent. of the tax levy by increasing the amount of property pledged to the support of the government; tends to increase the number of persons who voluntarily obey law, and thus to decrease the expense of government for the enforcement of obedience to law; cares for the unfortunate, and by every dollar so spent lessens the amount necessary to be raised by taxation; restrains, educates, and cares for the unruly and relieves government of the unwelcome task and burden. And if this work be not done, or is undertaken by the State, the increase in expense and decrease in efficiency and true helpfulness would be enormous. These considerations alone, void of all sentiment or taint of religious creed, purely commercial in character, dealing only with tangible values known in the exchanges of industries, outweigh a thousand-fold any amount of tax the municipality, county or State can collect from private property devoted to such uses. Judged by the standard of the market it is good business to exempt all such property from taxation.

9. In discussing a question of this character I am aware that there is one powerful consideration in the minds of many which I have not touched. I will not shirk it. It is the broad question of the absolute separation of Church and State. Those whose sensitiveness impairs their judgment, contend that by encouraging religious institutions to the extent of exempting their property from taxation, the State becomes a partner in teaching Church creeds. If the State makes no discriminations in its exemption then it must become a partner in teaching all Church creeds. Surely this is the ripe fruit of religious liberty. Divorce the State from creeds, but from religion, never. Religion is founded on right doing. Right doing is justice. Justice is the righteousness which the State is organized to establish. Those who clamor for the divorce of the State from religion, clamor for the destruction of the foundations of the State, the foundations of civilization. They catch at the husks of words without apprehending their true meaning or import. The more religion is infused into the affairs of the State, the more just enacted laws will become, the more just will be the administration of law. Justice and religion are one.

10. A further step in the direction of encouraging those qualities that make for good character should be taken by exempting from taxation all property that is easily concealed or conveyed beyond the jurisdiction of the taxing authority. Taxation on such property cannot avoid placing a premium on that phrase of fraud known as tax-dodging. It cannot be claimed that the inherently dishonest are made worse by it, but the number of legally honest are largely increased by it, while the inherent honest carry the burden of the taxation as a fine for their honesty. To fine honesty and pay a corresponding premium on dishonesty is not good business for the State nor for society.

11. Following in this direction it will be found good policy to exempt non-profit producing property, such as household furniture, libraries, musical instruments and works of art. Also to go over the line into the domain of the profit-producing property and exempt the workman's tools, the farmer's implements and products, the manufacturer's machinery and products. The more such property is owned and enjoyed the better for the

comfort and welfare of every individual and for the general welfare. One other consideration in this connection is found in the fact that the majority portion of all such property is owned in such small holdings that the assessment and collection of taxes, on all would defeat the object of taxation, the securing of an income, because the necessary expenses of assessment and collection would so nearly equal the income. Exemptions must be made in these classes of property, and if made at all to be just the exemption must include all the property of the classes dealt with. The entire exemption of personal property is not so serious a question as many suppose. In the State of New York, where the holdings of personal property, so-called, are probably larger in proportion to real estate values than in any other State in the Union, the report of the State Comptroller gives the following figures for 1893:

Real estate.....	\$3,626,645,093
Personal property.....	411,413,836
Total valuation.....	\$4,038,058,929
State tax levied for all purposes.....	\$10,418,192.08
Rate of State tax on each dollar of valuation,	2.58 mills.

Had the entire amount of personal property been exempt, the rate on each dollar of valuation would have been 2.87 mills. A less rate than has been obtained in 24 out of the 35 years exhibited in the table. Surely in the light of all the facts and considerations pertaining to the question, the State does not secure sufficient advantages from the taxation of personal property to justify the levying of the tax. In this particular it is doing bad business. No State can afford to pay the reward for dishonesty that is easily secured through dodging a tax on personal property.

TAXES: A MEANS OF RESTRICTING EVIL.

- i. The republic was created:—
 - (a) To establish justice.
 - (b) To ensure domestic tranquility.
 - (c) To provide for the common defence.
 - (d) To promote the general welfare.
 - (e) To secure the blessings of liberty.

Not one of these objects can be fully realized without restraining or obliterating all evils. A wrong act voluntarily done transforms a blessing into a curse, transforms liberty into license. The right doing of a majority enslaves the wrong doers. The wrong doing of a majority enslaves the right doers. The dynamic control of individuals by the State is right or wrong according to the honesty and intelligence of the majority that governs. Divinity is not in the King nor in the voice of the people, but in the intelligence of the individual. When man utters a truth, God speaks.

2. If it is good policy to encourage the cultivation of those qualities that make for good character, it is undeniably good policy to discourage the development of all qualities that make for bad character. The reverse of the reasons advanced for exempting from taxation all property used for the purposes of private education, religion, charities and reformatories, are the reasons for taxing all property used for the purposes of catering to and satisfying the demands of vice. Beyond this there are the reasons for using the taxing power for the regulation and suppression of all social evils to the full extent for which they can find support in public opinion. The entire cost of enforcing obedience to law, and the enormously greater cost assessed upon society, through all the expenses privately incurred to secure protection from invasions by law-breakers, is the direct, and the involuntary tax levied upon property, by authority of law, and by the extortions of vice. A tax upon property used for the purposes of vice, will not in itself make good more than an infinitesimal fraction of the cost of vice borne by the honest and industrious through its exactions. As a question of getting value in return for value given, the honest and industrious have no choice but to exact from those engaged in any vocation of evil influence, detrimental to good morals, good health, or disquieting to domestic tranquility, as heavy payments as can be taken from them in the form of licenses, permits, fines, fees or excises.

3. It is a trite remark that people cannot be made good by legislation. This is true. Were it not true, mankind would not now be suffering from evils forbidden by the ten commandments. Was it for this reason bad business to write them?

Goodness is a quality of character resulting from conduct. Evil is as surely the fruit of conduct. People cannot, as a matter of fact, be made better by legislation. This does not relieve those who enact legislation from the duty of so directing everything done by authority of law, that it shall in the greatest possible degree help those to be better who are inclined to be better, and restrain those from becoming evil who are inclined to be evil. It is well enough to declare, in the light of pure truth, that virtue does not exist in those who are virtuous only from lack of opportunity, but it is better to deprive them of opportunity and thus cause them to practice all the virtue of which they are capable. The most far-reaching and damaging charge that can be made against enacted law, is that it furnishes a false and low standard of honesty. Multitudes of persons are made dishonest through seeking to take every advantage which the law will allow them. In the same manner the opportunities to indulge in vicious and evil practices existing under protection of law cause multitudes of persons to overstep the boundaries of right conduct. The standard of honesty expressed in enacted law furnishes an infallible measure of the morality of a people. The vices tolerated by society furnish an infallible measure of its degree of righteousness. Individuals, municipalities, states and nations must take rank in the court of justice according to what they do, not what they profess.

4. All persons catering to vice are governed by mercenary motives. The more their opportunity for making gains is restricted, the less will be the inducement for them to make the ventures. All attempts to overcome evil must be directed against two objects. First, the restraint or the removal of the desire to do evil. Second, to make catering to vice unprofitable. When work is undertaken in this field it will become quickly apparent that while millions of money are spent for the satisfaction of vicious habits, the public will not pay for the kind of education of which it is most in need. People have been taught for ages that "the way of the transgressor is hard," and during all these ages the wicked have prospered and *the way of the reformer has been and still is hard.*

There are more saloons than Sunday schools, and they are open more hours simply because more money can be made by

supplying persons with what they want than by trying to educate them to want only that which is best for them. The slow growth of righteousness is attributable to the fact that many who have acquired much property have not learned to value good character, and use their property for the satisfaction of vices and in the pursuit of pleasures that do not make for good. When the day comes in which catering to vice is unprofitable, and doing good is profitable, then will come to society the knowledge of a joy to it now unknown, and when that knowledge comes sorrow will flee away to those that are capable of it.

5. The authority to use the power of taxation for the regulation, suppression, and if possible the annihilation of evil, is written in every line giving the objects for which government is organized. The attainment of those objects is possible only through securing, by authority of law, to all influences that work for good, the largest liberty; to all influences that work for evil, the narrowest restrictions. To the accomplishment of these objects all reforms of enacted law should be consistently and continuously directed.

APPENDIX.

TO PROVIDE A JUST SYSTEM OF TAXATION.

PROPOSED BY ALLEN RIPLEY FOOTE, WASHINGTON, D. C.

Author of the Discussion of the Economic Principles Involved in—"The Law of Incorporated Companies Operating Under Municipal Franchises."

[NOTE.—Suggestions are invited from any person, firm, corporation or association, and from the taxing authorities of any municipality, county or State, designed to make this proposed law more certain in construction, more simple in its application, more completely just in its effects.]

TAXATION.

1. All charges for the support of the Government and for all other public purposes are taxes.

2. All property shall be assessed for taxation at its full value in current funds. All exchangeable products upon which labor has been expended, the ownership of which is protected by law, are property. Securities representing the ownership and the value of the property are not property and shall not be taxed.

3. The tax levy shall be laid at a uniform rate per cent. on the assessed value of all property for the same tax levied within the jurisdiction of the State and of each division thereof.

4. All property assessed for taxation shall be entered in the books of the tax assessor for the tax district in which it is located, in the name of the owner, user, or person having the property in charge.

5. Bills for taxes shall be made in the name of the owner, user, or person having the property in charge, as entered in the assessor's books, and the payment of the same shall be a legal payment for the full amount of the tax bill of any debt or obligation of any kind due from such person to the true owner of the property upon which the levy was made.

6. Tax bills shall be a lien upon the property on which the levy was made and may be sold for non-payment, as provided by law.

7. Property shall not be taxed in any way except as herein provided. Tax assessments shall be made but once in each year, and the levy for all State, county and municipal taxes shall be entered in the same bill. Charges shall not be made by State, county, municipal or other public authorities, for the support of the Government or any other public purpose, except a property tax, for the right or privilege of engaging in any industry, business or vocation.

8. The legislature may exempt the whole of any class of property from taxation, but it shall not make any partial exemption by authorizing a decrease in valuation, or of the rate per cent. of a tax levy for one or more classes of property less than the unexempted whole of a class, nor shall it exempt a part of the property of any class.

9. Special assessments and tax levies may be made, in consideration for special benefits accruing from public improvements, upon all property securing an increment of value by reason of such improvements.

10. Fines may be assessed and collected for violations of law; charges may be assessed and collected for costs of courts in all legal procedures; for costs of records on all recorded instruments or documents; for all public inspections, supervision and audits; and license fees may be assessed and collected for the control of all places of public amusement; the regulation or suppression of all immoral practices; the protection of health, and the supervision of public nuisances.

11. The legislature shall not delegate the right to exercise the power of taxation for any purpose, to any political division of the State or other public authority without providing by law that the books of accounts of such division shall be kept as directed by the State Comptroller who shall audit all such accounts annually.

PATCHING HOLDERS WHILE IN USE.

WRITTEN FOR THE AMERICAN GAS LIGHT ASSOCIATION, BY J. H. FINDLAY,
OF OGDENSBURG, N. Y.

When the worthy Secretary wrote me asking if I would read a paper at our Washington meeting, I was up to my ears in work, repairing an old holder which I had patched many a time before. As I read the letter it struck me at once that patching gas holders while in use might be a good subject for me, particularly as it was worry at that moment, and so here goes. To begin with, the process is very simple, and I hope none of you will ever be placed in the position I was when I first came to Ogdensburg. The gas company was poor. It had been in operation 20 years prior to my taking charge, the works much out of repair and no money to make improvements with. The company owned two gas holders, a new one of 30,000 capacity, built a year before I took charge, and situated about a quarter of a mile from the works. The other of 60,000 capacity with a centre pole, and a fairly good looking chap for his years, well built and put together. There were a few leaking seams. This holder I decided to keep in use. The old fellow stands only 12 feet from the retort house, is uncovered and

therefore exposed to all the storms of our "North Pole" latitude. It had not been properly painted or cared for either. Bituminous matter from the works had fallen on it and rusted it, and there were some leaky seams back of the rivets which had to be repaired. I conceived the idea of making strips 10 inches wide and the full length of the sheet, and drilling holes $1\frac{1}{4}$ inches apart, a half inch from the edge, painting the side to be layed next the holder with a mixture of red lead, white lead, litharge and boiled oil. Laying the strip on the holder, we drilled through the holes in the new plate into the holder, the holes in the holder being a little smaller than those in the new sheet, so as to allow the screws to pass. We tapped the holes in the holder with a fine thread and screwed the new plate down with round-headed screws, annealing same before using, drawing the new plate up and making a tight joint. I put on 10 or 15 of these strips at that time, and as the holder required I kept putting them on as you would shingle a house until the top side of the holder nearest the works is almost entirely recovered. A new trouble then arose. The sheets along the angle iron began to rust out just behind the rivets, and in order to fasten new sheets to the angle iron I cut the heads off the rivets already in, leaving the plate just as it was. A new plate was cut, formed to the angle iron around the holder and drilled or punched so as the holes would correspond with those already in the angle iron. Then I drove out the rivets with a punch and tapped the angle iron, then following the same process as before.

The sheets on the side also began to rust away from the angle iron as on the top, and I had to put on plates 15 inches deep and 4 feet long, three-quarters of the way around the holder; and when I get home I am going to finish it all the way around. I am satisfied with them from the fact that the sheets I first put on, about 20 years ago, are tight to-day and will remain so as long as I last. I had a very good test of the strength of the work when I had an explosion at the works last winter. My pumping house and other buildings were blown up in the air. A stone fell on top of the holder and made a tear in it 6 feet long, allowing the gas to escape and the crown of the holder to resemble an umbrella turned wrong side out. The patches stood the test perfectly.

Having the tools on hand we set to work repairing the break and started to inflate the holder immediately and furnished gas that night from it. The crown resumed its former shape and stands now as proudly as in the days of yore.

TOPICAL QUERIES.

1. Which is the better pipe for use in services—steel or iron—and why?
2. Which rusts the more rapidly in service use—steel or iron? What kind of yarn is best suited for lead joints—the plain or tarred yarn—and why?
3. What kind of yarn is best suited for cement joints—the plain or tarred yarn—and why?
4. What is the best cement to use for making cement joints?
5. Can anyone describe or mention any new apparatus or instrument useful in the line of gas testing or measurement?
6. The Proceedings of the Association being copyrighted, what effect does that have upon papers published therein and read at the meetings?
7. An outdoor holder used for mixture of coal and water gas in northern climate has the horizontal side seams lap down on the outside and they have become leaky. Is there any good method by which they may be made permanently tight?
8. Why are holders built with horizontal side seams to lap down instead of up on the outside?
9. What should be allowed as a general average for the shrinkage of Lowe water gas in its change from the relief holder through the exhauster, purifiers and meter to the distributing holder, aside from that due to difference in temperature?
10. Can and will anyone make known their experience with the prepayment meters?
11. Does any gas company make a special department of attention to the proper use of its product by its customers, and the selection and arrangement of burners or appliances specially adapted for each set of conditions met; if so how have results justified the plan?

UNITED STATES PATENTS RELATING TO GAS.

ISSUED SINCE JULY 1ST, 1894.

July 3d, 1894.

- 522,263.** GAS-GOVERNOR. William O. Ludoici, San Francisco, Cal. Filed Dec. 10, 1892. Serial No. 454,760.
- 522,325.** GAS-MAKING APPARATUS. Jeannot W. Keneval, Chicago, Ill. Filed Nov. 14, 1893. Serial No. 490,948.
- 522,326.** GAS-MAKING APPARATUS. Jeannot W. Keneval, Chicago, Ill. Filed Nov. 14, 1893. Serial No. 490,949.
- 522,358.** GAS-RADIATOR. Louis Strimbau, New York, N. Y. Filed March 28, 1894. Serial No. 505,377.
- 522,418.** CARBURETOR. Malvern W. Iles, Denver, Col. Filed Sept. 12, 1892. Serial No. 445,721.
- 522,480.** AUTOMATIC GAS-GOVERNOR, John J. Myers, Baltimore, Md. Filed Dec. 6, 1893. Serial No. 492,911.
- 522,515.** SELF-LUBRICATING STOP-COCK. Edward M. Dart, Providence, R. I. Filed Feb. 15, 1893. Serial No. 462,430.
- 522,573.** AIR-SUPPLYING APPARATUS FOR CARBURETORS. George H. Burrows, Somerville, Mass. Filed Nov. 25, 1893. Serial No. 491,993.
- 522,574.** CARBURETOR. George H. Burrows, Somerville, Mass. Filed Mar. 30, 1894. Serial No. 505,709.

July 10th.

- 11,430.** CARBURETOR. Oliver Vanorman, Los Angeles, Cal., assignor of one-half to Frank J. Cooper, same place. Filed Dec. 10, 1891. Serial No. 414,639. Original No. 457,803, dated Aug. 18, 1891. Reissue.
- 522,582.** SIPHON TEST-BOX FOR GAS-MAINS. Adolphe Bouvier, Lyons, France. Filed Sept. 15, 1893. Serial No. 485,575. Patented in France, Sept. 8, 1890; No. 208,098.
- 522,600.** GAS CUT-OFF DEVICE. Arthur Kleinfeldt, Brooklyn, N. Y., assignor to the Perfection Safety Gas Burner Company, New Jersey. Filed March 20, 1893. Serial No. 466,954.

- 522,601.** GAS CUT-OFF DEVICE. Arthur Kleinfeldt, Brooklyn, N. Y., assignor to the Perfection Safety Gas Burner Company, New Jersey. Filed June 28, 1893. Serial No. 479,093.
- 522,687.** APPARATUS FOR MANUFACTURING GAS. Edwin R. Ellsworth, Brooklyn, N. Y. Filed Oct. 31, 1893. Serial No. 489,638.
- 522,705.** APPARATUS FOR CHARGING GAS-RETORTS. Josiah C. Chandler, London, England. Filed Nov. 29, 1890. Serial No. 373,054.
- 522,712.** GAS-ENGINE. Feodor Hirsch, Steinway, N. Y. Filed Sept. 6, 1893. Serial No. 484,930,
- 522,746.** PROCESS OF AND APPARATUS FOR ANALYZING GASES. Edward A. Uehling and Alfred Steinbart, Birmingham, Ala. Filed Feb. 26, 1894. Serial No. 501,896.
- 522,811.** EXPLOSIVE GAS-ENGINE. Jesse Walrath, Racine, Wis. Filed May 2, 1893. Serial No. 472,681.
- 522,850.** HEATER. John McLoughlin, Boston, Mass. Filed Oct. 3, 1893. Serial No. 487,069.
- 522,908.** GAS COOKING AND WATER-HEATING RANGE. Benjamin S. Koll, St. Louis, Mo., assignor by mesne assignments to Lewis B. Jones, same place. Filed March 23, 1893. Serial No. 467,265.

July 17th.

- 522,968.** APPARATUS FOR CARBURETING AIR. William C. Clarke, New York, N. Y., and Arthur B. Griffen, Newark, N. J., assignors to the Gilbert & Barker Manufacturing Company of Massachusetts. Original application filed April 7, 1892. Serial No. 428,248. Divided, and this application filed Oct. 27, 1892. Serial No. 450,130.
- 523,086.** BURNER FOR BURNING GASEOUS FUEL. Joseph F. Hewitt, Allegheny, Pa. Filed June 21, 1892. Serial No. 437,515.
- 523,087.** FIRE-PLACE FRONT. Joseph F. Hewitt, Allegheny, Pa. Filed June 9, 1893. Serial No. 477,127.
- 523,071.** WATER-HEATER. Alfred H. Humphrey, Frederick J. Humphrey and Herbert S. Humphrey, Kalamazoo, Mich. Filed Dec. 4, 1893, Serial No. 492,805.
- 523,088.** REGENERATING FURNACE. Samuel M. Trapp, Chicago, Ill., assignor by direct and mesne assignments to the Donan-Trapp Climax Gas Producer Company, same place. Filed March 9, 1894. Serial No. 503,029.

- 523,089.** FURNACE. Samuel M. Trapp, Chicago, Ill., assignor by direct and mesne assignments to the Donan-Trapp Climax Gas Producer Company, same place. Filed March 13, 1894. Serial No. 503,467.
- 523,112.** APPARATUS FOR THE MANUFACTURE OF GAS. Edwin R. Ellsworth, Brooklyn, N. Y. Filed Sept. 14, 1893. Serial No. 485,481.
- 523,187.** GAS-BURNER ATTACHMENT FOR HEATING CURLING IRONS. William H. Wellpott and Otto F. Boellner, St. Louis, Mo. Filed Jan. 29, 1890; Serial No. 498,324.
- 523,224.** APPARATUS FOR MANUFACTURING GAS. Frederick Mayer, Baltimore, Md. Filed January 31, 1894. Serial No. 498,567.
- 523,291.** GAS-METER. Oliver C. Pudan and Louis B. Fulton, Pittsburg, Pa., assignors to the Chaplin-Fulton Manufacturing Co., same place. Filed January 18, 1894. Serial No. 497,235.
- 523,303.** VAPOR-BURNER. Charles H. Childs, Grand Rapids, Mich., assignor by mesne assignments to Thomas Friant, T. Stewart White, Thomas M. Peck, Felix Raniville, Daniel McCoy, McGeorge Bundy, Joseph J. Tucker and Lois A. Giddings, same place. Filed March 13, 1893. Serial No. 565,715.

July 24th.

- 523,349.** GAS-METER. Charles W. Hinman, Boston, Mass. Filed January 25, 1894. Serial No. 498,048.
- 523,369.** ELECTRICAL IGNITING DEVICE FOR GAS-ENGINES. Alonzo J. Painter, Pasadena, Cal.; Nannie Painter, administratrix of Alonzo J. Painter, deceased. Filed July 28, 1893. Serial No. 481,696.
- 523,628.** GAS-HEATER FOR INTERNAL COMBUSTION ENGINES. William St. G. Elliott, Jr., Walden, N. Y. Filed November 12, 1892. Serial No. 451,774.
- 523,637.** COIN-FREED GAS Meter. John Hawkyard, Saddleworth, assignor by mesne assignments to William Coulson Parkinson, Cottage Lane, City Road, England. Filed March 15, 1894. Serial No. 503,748. Patented in England, August 12, 1890, No. 12,584; September 17, 1890, No. 14,655; May 4, 1892, No. 8,410, and May 16, 1893, No. 9,771.
- 523,641.** VAPOR-BURNER. Edward Kells, Cleveland, Ohio, assignor by direct and mesne assignments to the Dangler Stove and Manufacturing Co., same place. Filed April 11, 1893. Serial No. 469,904.
- 23,504.** GAS-BURNER. Design, Lazard Kahn, Hamilton, Ohio, assignor to F. & L. Kahn & Bros., same place. Filed June 2, 1894. Serial No. 513,323. Term of patent seven years.

- 23,505.** GAS-STOVE. Design, Lazard Kahn, Hamilton, Ohio, assignor to F. & L. Kahn & Bros., same place. Filed June 2, 1894. Serial No. 513,324. Term of patent seven years.

July 31st.

- 523,706.** APPARATUS FOR SUPPLYING JACKETS OF GAS-ENGINES WITH WATER OR OTHER COOLING LIQUIDS. Feodor Hirsch, Steinway, assignor to himself and Eugene M. Jerome, New York, N. Y. Filed April 12, 1893. Serial No. 470,086.
- 523,734.** REACTIONARY GAS MOTOR-ENGINE. William A. Shaw, Pittsburg, Pa. Filed October 7, 1887. Serial No. 251,754.
- 523,766.** VAPOR-BURNER. Peter J. Fitzgerald. Hyde Park, Mass. Filed June 17, 1893. Serial No. 477,960.
- 23,529.** GAS COOK-STOVE. Design, Charles Whittingham, Cleveland, Ohio. Filed July 3, 1894. Serial No. 516,505. Term of patent seven years.
- 23,530.** GAS COOK-STOVE. Design, Charles Whittingham, Cleveland, Ohio. Filed July 3, 1894. Serial No. 516,506. Term of patent seven years.
- 23,531.** GAS-HEATER. Design, Charles Whittingham, Cleveland, Ohio. Filed July 9, 1894. Serial No. 517,012. Term of patent seven years.

August 7th.

- 524,054.** GAS-LIGHTING ATTACHMENT. Frank M. Brooks, Brooklyn, N. Y. Filed January 31, 1894. Serial No. 498,678.
- 524,061.** COIN FREED APPARATUS FOR THE AUTOMATIC SALE AND DELIVERY OF GAS. John Gow, London, England, assignor to the Gas Meter Company, Limited, same place. Filed April 27, 1894. Serial No. 509,173. Patented in England, July 15, 1892, No. 13 037.
- 524,108.** STEAM SUPPLY AND CIRCULATING SYSTEM FOR WATER-GAS APPARATUS. Olaf N. Guldlin, Fort Wayne, Ind. Filed Nov. 21, 1893. Serial No. 491,590.
- 524,111.** GAS FIRE-ENGINE. Daniel Kegler, Mannheim, Germany. Filed October 14, 1893. Serial No. 488,125. Patented in England, July 25, 1893, No. 14,344; in Switzerland, July 27, 1893, No. 7,783; in Germany, August 5, 1893, No. 11,005; in France, August 10, 1893, No. 218,928; in Italy, August 19, 1893, No. 271, and in Belgium, August 23, 1893, No. 80,657.

August 14th.

- 524,399.** HEATER. Maurice Ready, Dayton, Ohio. Filed May 14, 1894. Serial No. 511,154.
- 524,449.** GAS-LIGHTING DEVICE. Carl W. Muchall, Wiesbaden, assignor to the Deutsche Gasglühlicht-Actiengesellschaft, Berlin, Germany. Filed Jan 6, 1894. Serial No. 496,011. Patented in England, December 15, 1893. No. 24,192.
- 524,544.** APPARATUS FOR MAKING GAS. Edwin R. Ellsworth, Brooklyn, N. Y. Filed Nov. 3, 1893. Serial No. 489,939.

August 21st.

- 524,859.** DRY GAS-METER. Edward McGrady, Stoneham, Mass. Filed Jan. 20, 1894. Serial No. 497,572.

August 28th.

- 525,038.** VAPOR-BURNER. William H. Wilder and Earl A. Thissell, Northampton, Mass., and John A. Lannert and William R. Jeavons, Cleveland, Ohio. Filed March 13, 1893. Serial No. 465,709.
- 525,069.** HOT-AIR HEATING-STOVE. Cyrus S. Dean, Fort Erie, Canada, assignor of one-half to Charles O. Rano, Buffalo, N. Y. Filed Nov. 3, 1893. Serial No. 489,900.
- 525,072.** GAS-PURIFYING APPARATUS. George E. Gilhaus and John A. Richter, Kansas City, Kans. Filed Jan. 19, 1894. Serial No. 497,345.
- 525,109.** GAS-STOVE. Charles H. Miller, Erie, Pa. Filed Nov. 24, 1893. Serial No. 491,868.
- 525,131.** PROCESS OF AND APPARATUS FOR MAKING GAS. William F. Browne, New York, N. Y. Filed April 18, 1891. Serial No. 389,537.

September 4th.

- 525,331.** VAPOR-BURNER. Milton E. Company, Hamilton, Mich. Filed July 24, 1893; Serial No. 481,303.
- 525,350.** VAPOR-BURNER APPARATUS. Albert J. Lindemann, Milwaukee, Wis. Filed May 3, 1894. Serial No. 509,925.
- 525,358.** GAS-ENGINE. Fred C. Olin, Dunkirk, N. Y. Filed August 26, 1892. Serial No. 444,215.
- 525,541.** PUPPET-VALVE FOR PISTONS OF AIR OR GAS-PUMPS. William F. Garrison, Brooklyn, N. Y. Filed Jan. 17, 1893. Serial No. 458,655.

525,651. GAS-ENGINE. William W. Grant, Brooklyn, N. Y. Filed Feb. 24, 1894. Serial No. 501,398.

525,665. STOVE FOR BURNING GAS. Donald McDonald, Louisville, Ky. Filed March 5, 1894. Serial No. 502,394.

September 11th.

525,696. LAMP. Robert M. Dixon, East Orange, N. J., assignor to the Safety Car Heating and Lighting Company, New York, N. Y. Filed Dec. 27, 1893. Serial No. 494,832.

525,828. ELECTRICAL IGNITER FOR GAS OR HYDROCARBON ENGINES. Paul A. N. Winand, Philadelphia, Pa., assignor to Messrs. Schleicher, Schumm & Co., same place. Filed July 26, 1893. Serial No. 481,568.

525,857. GAS-ENGINE. James McGeorge, Cleveland, Ohio. Filed Oct. 23, 1893. Serial No. 488,900.

525,858. APPARATUS FOR MAKING ANHYDROUS AMMONIA. Patrick J. McMahon, Tangiphoa, La., assignor to the Standard Fireless Company, Chicago, Ill. Filed Oct. 7, 1891. Serial No. 407,983.

525,859. AMMONIACAL GAS-MOTOR. Patrick J. McMahon, Tangiphoa, La., assignor to the Standard Fireless Company, Chicago, Ill. Filed Dec. 12, 1891. Serial No. 414,811.

September 18th.

526,138. COIN-CONTROLLED GAS-METER. William Alexander, Birkenhead, and William E. Thompson, Liverpool, England. Filed March 10, 1894. Serial No. 503,112. Patented in England, March 18, 1893; No. 5,830.

526,251. PREPAYMENT GAS METER. William N. Milsted, New York, N. Y. Filed April 30, 1894. Serial No. 509,504.

526,257. VESSEL FOR CONTAINING GAS UNDER PRESSURE. William W. Pope, Slough, England. Filed June 30, 1894. Serial No. 516,218.

526,288. AIR OR GAS-COMPRESSOR. Henry A. Barber, Watertown, N. Y., assignor of one-half to Albert H. Lefebvre, same place. Filed June 14, 1893. Serial No. 477,609.

526,348. EXPLOSIVE ENGINE. Henry F. Fraser, Antioch, Cal. Filed Sept. 19, 1893. Serial No. 485,875.

526,364. WATER-OIL GAS-APPARATUS. Henry Fourness, Manchester, England. Filed Dec. 21, 1892. Serial No. 455,875. Patented in England, Sept. 12, 1891; No. 15,469.

September 25th.

- 526,869.** GAS, OIL OR SIMILAR MOTOR-ENGINE. Henry H. Andrew and Alfred R. Bellamy, Reddish, near Stockport, England. Filed March 13, 1894. Serial No. 503,505. Patented in England, November 17, 1892, No. 208,031.
- 526,560.** HYDROCARBON BURNER. Lewis H. Cole and Jesse Bower, Lansing, Mich. Filed Dec. 19, 1893. Serial No. 494,044.
- 526,640.** COIN CONTROLLED GAS OR OTHER METER. Stephen Simpson, Mansfield, assignor of one-half to Francis Edward Dyke Acland, London, England. Filed March 13, 1894. Serial No. 503,502.

UNITED STATES PATENTS RELATING TO GAS.

EXPIRED SINCE JULY 1ST, 1894.

July 3d.

- 192,589.** GASOLINE STOVES. F. A. Lyman and A. B. Lyman, Cleveland, Ohio. Filed Dec. 1, 1876.
- 192,629.** ATTACHMENTS FOR OIL OR GAS COOK STOVES. O. F. Stedman, Westfield, N. Y. Filed June 23, 1877.
- 192,637.** METHODS OF APPLYING POWER IN STEAM, AIR OR GAS-ENGINES. Wm. R. Comings, New Britain, Conn. Filed Dec. 11, 1876.

July 10th.

- 192,825.** APPARATUS FOR CARBURETING AIR. R. P. Hanglitter, Philadelphia, Pa., assignor of a part of his right to L. E. F. Toboldt and James McGuinness, same place. Filed June 16, 1877.
- 192,964.** PORTABLE PERCUSSION TORCHES FOR LIGHTING GAS. W. W. Batchelder, New York, N. Y. Filed July 3, 1877.
- 193,007.** APPARATUS FOR CARBURETING AIR. George W. Lamb, Westonburg, N. Y. Filed July 3, 1877.
- 193,034.** CARBURETING MACHINE. C. H. Pierson, Janesville, Wis., assignor of one-third his right to S. E. Phillips and Wm. Puffer, same place. Filed May 9, 1877.

- 193,048.** HYDROCARBON BURNERS. Wm. Stewart, R. J. Stewart and C. W. Makepeace, Patterson, N. J. Filed June 14, 1877.

July 17th.

- 193,282.** CARBURETERS. Oliver P. Drake, Frank G. Drake, administrators, Boston, Mass. Filed April 13, 1877.

July 24th.

- 193,397.** GAS-WASHING APPARATUS. W. M. Cosh, Conshohocken, Pa. Filed April 2, 1877.
- 193,407.** APPARATUS FOR MANUFACTURING ILLUMINATING GAS. W. S. Hill, Hyde Park, Mass. Filed March 9, 1877.
- 193,515.** GAS-GOVERNORS. C. W. Isbell, New York, N. Y. Filed May 8, 1877.
- 193,535.** GAS-LIGHTING TORCHES. E. L. Megill, Brooklyn, N. Y. Filed Jan. 31, 1877.
- 193,548.** GAS-GOVERNORS. R. H. Plass and H. McManus, New York, N. Y., said McManus assignor to said Plass. Filed Nov. 15, 1876.
- 193,561.** APPARATUS FOR CARBURETING GAS. C. A. Sirié, Paris, France. Filed May 28, 1877.

July 31st.

- 193,601.** GAS-BURNERS. Charles S. Ford, Philadelphia, Pa., assignor of one-half his right to J. J. Krodel, Columbia, Pa. Filed June 21, 1877.
- 193,604.** GAS-BURNERS. John G. Hanning, Indianapolis, Ind., assignor to Pioneer Brass Works, same place. Filed June 11, 1877.

August 7th.

- 193,827.** PIPES FOR STREET-GAS AND WATER STOP-COCK BOXES. A. W. Morgan, Buffalo, N. Y. Filed June 20, 1877.
- 193,845.** GAS-BURNER. Wm. Bedell and W. S. Bedell, New York, N. Y. Filed July 13, 1877.
- 193,911.** CARBURETERS. David E. Bangs, Boston, Mass. Filed May 26, 1877.
- 193,920.** PROCESS FOR OBTAINING AMMONIA-SALTS. Samuel Cabot, Jr., Boston, Mass. Filed March 26, 1877.

193,937. OIL AND GAS-STOVES. Oliver Edwards, Florence, Mass. Filed June 20, 1877.

193,979. GAS-RETORTS. A. W. M. Maas, Mobile, Ala., assignor of two-thirds his rights to E. B. Lott, same place, and W. H. Hardy, Meridian, Miss. Filed Dec. 21, 1876.

August 14th.

194,025. GAS-BURNERS FOR PRODUCING HEAT. Thomas R. Almond, Brooklyn, N. Y. Filed Jan. 6, 1877.

194,041. APPARATUS FOR REGULATING THE SUPPLY OF STEAM TO GAS-EXHAUSTERS. Reuben K. Huntoon, Wakefield, assignor to Allen Governor Company, Boston, Mass. Filed Feb. 6, 1877.

194,047. GAS-MOTOR ENGINES. N. A. Otto, Deutz, Germany. Filed July 13, 1876.

August 21st.

194,299. PROCESS FOR PREVENTING THE FOULING OF GAS-LIME. F. A. Geuth and G. F. Barker, Philadelphia, Pa., assignor of one-half their rights to T. R. Brown and H. Bower, same place. Filed May 1, 1877.

194,328. ELECTIC GAS-BURNER. A. L. Bogart, New York, N. Y. Filed July 9, 1877.

194,501. PROCESS FOR THE PRODUCTION OF CARBONIC OXIDE GAS FOR HEATING AND WELDING. William S. Sutherland, Coombs Wood, Halesowen, England. Filed March 12, 1877.

August 28th.

194,561. VAPOR-BURNER. C. H. Prentiss, Cleveland, Ohio. Filed June 11, 1877.

194,631. GAS-BURNERS. J. D. West, East Orange, N. J., and W. H. Darby, Brooklyn, N. Y. Filed Nov. 21, 1876.

September 4th.

194,798. APPARATUS FOR GENERATING GAS. J. S. Wood, Brooklyn, N. Y. Filed Jan. 24, 1877.

194,873. VAPOR-BURNERS. A. W. Johnson, New Haven, Conn. Filed July 24, 1877.

September 11th.

- 194,998.** MACHINERY FOR CHARGING GAS RETORTS. Charles F. Dieterich, Baltimore, Md. Filed Nov. 6, 1876.
- 195,023.** REFLECTORS FOR CHADELIERS. George H. Kitchen, Rye, N. Y. Filed August 4, 1877.
- 195,054.** GAS DROP-LIGHTS. William B. S. Taylor, Westfield Township, Union County, N. Y. Filed May 9, 1877.
- 195,088.** COMBINED STEAM AND GAS-GENERATING APPARATUS. Wm. F. Browne, New York, N. Y., assignor to Hydrocarbon Steam Generating Co. Filed Dec. 27, 1876.
- 195,090.** GAS PIPES AND BURNERS FOR PREVENTING FROST ON SHOW WINDOWS. W. K. Chase, Lowell, Mass., assignor of one-half his rights to Charles H. Weston, same place. Filed Feb. 1, 1877.
- 195,182.** EXHAUST FANS OR BLOWERS. B. F. Sturtevant, Boston, Mass. Filed July 30, 1877.

September 18th.

- 195,240.** VAPOR-BURNERS. Henry Wellington, Brooklyn, E. D., N. Y. Filed March 24, 1877.
- 195,358.** ELECTRICAL GAS-BURNERS. E. A. Hill, Chicago, Ill. Filed Mar. 6, 1877.
- 195,404.** GAS-EXHAUSTER. Richard Salter and W. J. Salter, Covington, Ky. Filed June 13, 1877.

September 25th.

- 195,585.** GAS-ENGINES. F. Dieckmann, Cincinnati, Ohio. Filed July 16, 1877.
- 195,596.** GAS-REGULATORS. Charles A. Fenn and Rudolph Groeninger, St. Louis, Mo. Filed July 27, 1877.

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- Brilliant as the Sun, Five Ireland's Great New Light Visible a Hundred
Miles Away, *Water and Gas Review*, W. & G. R., V-1-21.
Modern Light House Service, Edward P. Adams, C. M., 6-34-297.
The Minneapolis, Minn., Arbitration, *American Gas Light Journal*,
A. G. L. J., LXI-7-217; P. A., XII-16-350.
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Some Reasons Why Philadelphia Should Retain and Not Sell Its Gas Works,
W. W. Goodwin, L. H. & P., XVII-1-10.
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- The Arbitrator's Reports in the Minneapolis Gas Rate Case,
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L. H. & P., XVII-2-169.
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Purchase of Gas Works by the Town Council of St. Ives, Cornwall,
Gas Engineer's Magazine, G. E. M., XI-220-3.
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Supply of Gas, Norton H. Humphreys, J. G. L., LXIV-1636-557.

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- Discussion on Georgé Anderson's Paper on "Differential Charges for Gas,"
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P. A., XII-14-308.
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Analysis of the Nottingham Corporation Gas Accounts, *Gas World*,
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- Sheffield United Gas Company, *Gas World*, G. W., XXI-527-233.
- Analysis of the Crystal Palace District Gas Company's Accounts,
Directors' Report, G. W., XXI-527-234, 237.
- Analysis of the Tottenham and Edmonton Gas Light and Coke Co's.
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- Annual Meeting of last above, *Gas World*, G. W., XXI-528-269.
- Decision in favor of the Cincinnati Gas Light and Coke Company,
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- Coal Transport Arrangements at the New Charlottenburg Gas Works,
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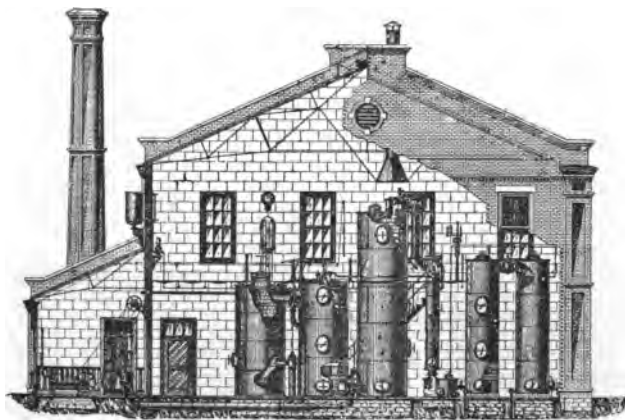
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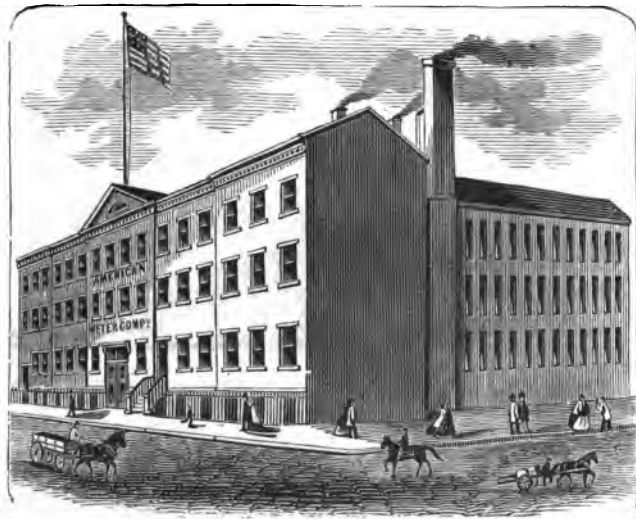
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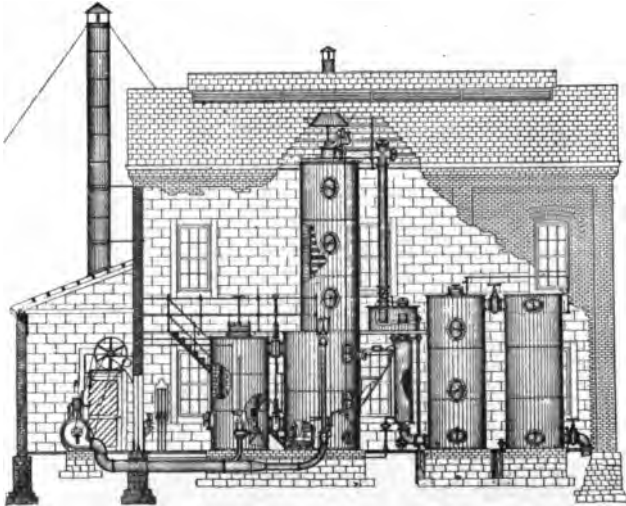
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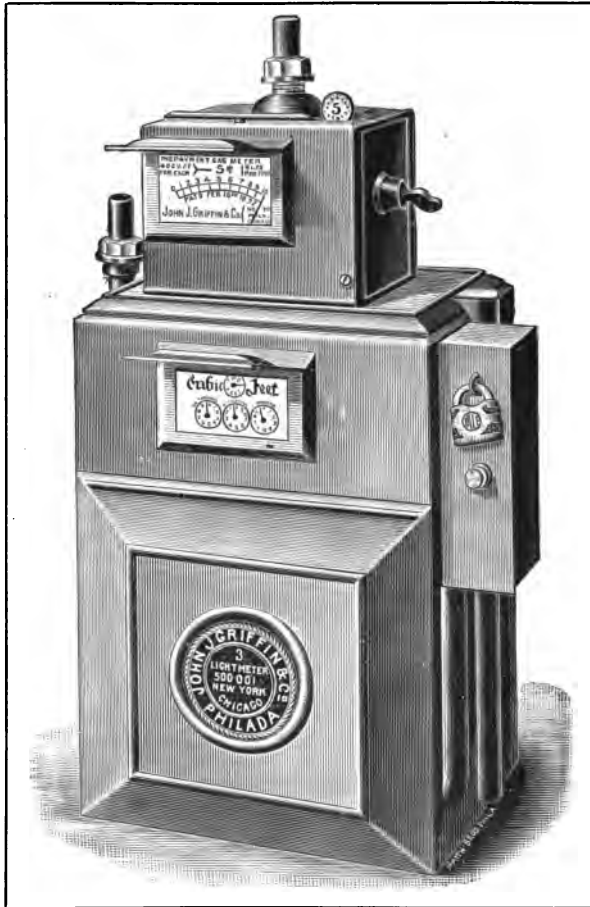
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TO THE
AMERICAN GAS LIGHT ASSOCIATION.

I desire to become an associate member of your Association,
and respectfully submit this application therefor ; and agree, if
elected, to conform to the requirements of the Constitution.

.....
(Name of Applicant.)

.....
(Position held by Applicant.)

.....
(Name of Company Applicant is with.)

.....
(Address of Applicant.)
.....
.....

Date..... 189

We hereby approve and endorse the above application for
associate membership.

..... } Active
..... } Members.
..... }

Passed by the Council.....

Date of Election.....

..... Secretary.

Vol. XI., No. 3.

JAN., 1895.

Whole No. 14.

PROCEEDINGS

OF THE

American Gas Light Association.



EDITED BY THE SECRETARY.

PUBLISHED QUARTERLY BY THE ASSOCIATION.

PROVIDENCE, R. I.

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E. L. FREEMAN & SON,
PROVIDENCE, R. I.

The authors only are responsible for their respective articles.

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THE PROCEEDINGS
OF THE
American Gas Light Association.

Vol. XI., No. 3.

JANUARY, 1895.

Whole No. 14.

TWENTY-SECOND ANNUAL MEETING
OF THE
AMERICAN GAS LIGHT ASSOCIATION,

HELD AT
BUILDERS' EXCHANGE HALL, WASHINGTON, D. C.
OCTOBER 17 AND 18, 1894.

FIRST DAY, MORNING SESSION—WEDNESDAY, OCTOBER 17, 1894.

The Association was called to order at 10 A. M. by the President, Mr. William H. Pearson, of Toronto, Ontario.

THE PRESIDENT—I am pleased to see so fair a representation here at this meeting, and have no doubt that as our meeting progresses a very much larger number will be found with us.

The following members were in attendance :

ROLL CALL.

Active Members.

Abel, W. G.,	-	-	Atlanta, Ga.
Adams, H. C.,	-	-	Philadelphia, Pa.
Adams, W. C.,	-	-	Richmond, Va.

Addicks, W. R.,	-	-	Boston, Mass.
Africa, W. G.,	-	-	Manchester, N. H.
Amory, Dr. R.,	-	-	Boston, Mass.
Archer, B. F.,	-	-	Camden, N. J.
Bailey, C. B.,	-	-	Washington, D. C.
Battin, I.,	-	-	Omaha, Neb.
Baxter, W. H.,	-	-	Petersburg, Va.
Beadenkopf, G.,	-	-	Baltimore, Md.
Bennett, C. A., Jr.,	-	-	Freehold, N. J.
Betts, E.,	-	-	Wilmington, Del.
Bigelow, A. F.,	-	-	Allentown, Pa.
Blodget, C. W.,	-	-	Brooklyn, N. Y.
Boardman, A. E.,	-	-	Macon, Ga.
Borgner, Cyrus,	-	-	Philadelphia, Pa.
Bowen, W. S.,	-	-	Lebanon, Pa.
Bredel, F.,	-	-	Milwaukee, Wis.
Brown, E. C.,	-	-	New York, N. Y.
Buckman, J.,	-	-	Philadelphia, Pa.
Byrne, T. E.,	-	-	Brooklyn, N. Y.
Cartwright, W.,	-	-	Philadelphia, Pa.
Chambers, J. S.,	-	-	Trenton, N. J.
Chollar, B. E.,	-	-	St. Louis, Mo.
Clark, W.,	-	-	Philadelphia, Pa.
Clary, E. D.,	-	-	Burlington, Ia.
Coffin, J. A.,	-	-	Gloucester, Mass.
Coggshall, H. F.,	-	-	Fitchburg, Mass.
Collins, A. P.,	-	-	New Britain, Conn.
Collins, C. R.,	-	-	Philadelphia, Pa.
Collins, John	-	-	Fishkill-on-Hudson, N. Y.
Corbett, C. H.,	-	-	Brooklyn, N. Y.
Cornell, T. C.,	-	-	Yonkers, N. Y.
Cowdery, E. G.,	-	-	Milwaukee, Wis.
Cressler, A. D.,	-	-	Fort Wayne, Ind.
Crowell, F. B.,	-	-	New York, N. Y.
Curley, T.,	-	-	Wilmington, Del.
Daly, D. R.,	-	-	Jersey City, N. J.
Daniels, J. M.,	-	-	Columbia, S. C.
Davis, F. J.,	-	-	Waltham, Mass.
Dell, J.,	-	-	St. Louis, Mo.

Dunbar, C. H.,	-	-	Philadelphia, Pa.
Dickey, C. H.,	-	-	Baltimore, Md..
Egner, F.,	-	-	Norfolk, Va.
Evans, C. H.,	-	-	Chicago, Ill.
Fay, W. J.,	-	-	Denver, Col.
Findlay, J. H.,	-	-	Ogdensburg, N. Y.
Flemming, D. D.,	-	-	Jersey City, N. J.
Floyd, J. R.,	-	-	New York City.
Fodell, W. P.,	-	-	Philadelphia, Pa.
Forbes, J.,	-	-	Chattanooga, Tenn.
Forstall, A. E.,	-	-	Newark, N. J.
Fowler, S. J.,	-	-	Springfield, Mass.
Fry, C. C.,	-	-	Lynn, Mass.
Gandey, A. C.,	-	-	Lambertville, N. J.
Gardner, J., Jr.,	-	-	Pittsburgh, Pa.
Gardner, W.,	-	-	Pittsburgh, Pa.
Gartley, W. H.,	-	-	Philadelphia, Pa.
Gates, F. W.,	-	-	Hamilton, Ontario.
Geggie, D. H.,	-	-	Quebec, Quebec.
Gerould, C. L.,	-	-	Mt. Vernon, N. Y.
Giblin, Jno. A.,	-	-	Ilion, N. Y.
Gibbons, P. H.,	-	-	Coatesville, Pa.
Gifford, N. W.,	-	-	New Bedford, Mass.
Graeff, Geo. W., Jr.,	-	-	Philadelphia, Pa.
Green, Jas.,	-	-	St. Louis, Mo.
Greenough, M. S.,	-	-	Cleveland, O.
Gribbel, Jno.,	-	-	Philadelphia, Pa.
Guldlin, O. N.,	-	-	Fort Wayne, Ind.
Harbison, J. P.,	-	-	Hartford, Conn.
Harper, G. H.,	-	-	Altoona, Pa.
Harris, J. A.,	-	-	Philadelphia, Pa.
Hauk, C. D.,	-	-	Philadelphia, Pa.
Hayes, C. J.,	-	-	Palatka, Fla.
Hayward, T. J.,	-	-	Baltimore, Md.
Helme, W. E.,	-	-	Philadelphia, Pa.
Hickenlooper, A.,	-	-	Cincinnati, O.
Hookey, G. S.,	-	-	Augusta, Ga.
Humphreys, C. J. R.,	-	-	Lawrence, Mass.
Isbell, C. W.,	-	-	New York City.

Jenkins, E. H.,	-	-	Columbus, Ga.
Jourdan, J. H.,	-	-	Brooklyn, N. Y.
Kellogg, L. L.,	-	-	Sioux City, Ia.
Keppelman, J. H.,	-	-	Reading, Pa.
Krumholz, Joseph,	-	-	Buffalo, N. Y.
Kuehn, Jacob L.,	-	-	York, Pa.
Lamson, C. D.,	-	-	Worcester, Mass.
Lane, J. W.,	-	-	Akron, Ohio.
Lansden, T. G.,	-	-	Washington, D. C.
Leach, H. B.,	-	-	Taunton, Mass.
Learned, E. C.,	-	-	New Britain, Conn.
Learned, W. A.,	-	-	Newton, Mass.
Lillie, L.,	-	-	Philadelphia, Pa.
Littlehales, T.,	-	-	Hamilton, Ontario.
Logan, W. J.,	-	-	Brooklyn, N. Y.
Loomis, Burdett,	-	-	Hartford, Conn.
Ludlam, E.,	-	-	Brooklyn, N. Y.
Lynn, J. T.,	-	-	Detroit, Mich.
Macdonald, B. J.,	-	-	Newburg, N. Y.
Mayer, F.,	-	-	Baltimore, Md.
McCleary, A. J.,	-	-	Philadelphia, Pa.
McDonald, Wm.,	-	-	Albany, N. Y.
McElroy, J. H.,	-	-	Pittsburgh, Pa.
McIlhenny, Jno.,	-	-	Philadelphia, Pa.
McIlhenny, Jas. S.,	-	-	Washington, D. C.
McKeige, F.,	-	-	New York, N. Y.
Milsted, W. N.,	-	-	New York, N. Y.
Morris, H. G.,	-	-	Philadelphia, Pa.
Neal, G. B.,	-	-	Boston, Mass.
Nettleton, C. H.,	-	-	Birmingham, Conn.
Newell, J. W.,	-	-	New Brunswick, N. J.
Norris, R.,	-	-	Philadelphia, Pa.
Nute, J. E.,	-	-	Fall River, Mass.
Page, C. H., Jr.,	-	-	Philadelphia, Pa.
Park, W. K.,	-	-	Philadelphia, Pa.
Pearson, W. H.,	-	-	Toronto, Ontario.
Pearson, W. H., Jr.,	-	-	Toronto, Ontario.
Pinkney, E. A.,	-	-	Utica, N. Y.
Prichard, C. F.,	-	-	Lynn, Mass.

Quinn, A. K.,	-	-	Newport, R. I.
Ramsdell, G. G.,	-	-	Philadelphia, Pa.
Reilly, J. W.,	-	-	Wilmington, N. C.
Rowland, W. L.,	-	-	Philadelphia, Pa.
Russell, D. R.,	-	-	St. Louis, Mo.
Searle, R. M.,	-	-	Johnstown, N. Y.
Shelton, F. H.,	-	-	Philadelphia, Pa.
Sherman, F. C.,	-	-	New Haven, Conn.
Slaney, H. C.,	-	-	Brooklyn, N. Y.
Slater, A. B.,	-	-	Providence, R. I.
Slater, A. B., Jr.,	-	-	Providence, R. I.
Smith, M.,	-	-	Wilkes-Barre, Pa.
Snow, Wm. H.,	-	-	Holyoke, Mass.
Stacey, Wm.,	-	-	Cincinnati, O.
Stiness, S. G.,	-	-	Pawtucket, R. I.
Summers, T. W.,	-	-	Penn Yan, Pa.
Taber, R. B.,	-	-	Boston, Mass.
Thompson, G. T.,	-	-	St. Louis, Mo.
Townsend, S. S.,	-	-	New York, N. Y.
Tracy, John,	-	-	Poughkeepsie, N. Y.
Vanderpool, E.,	-	-	Newark, N. J.
Walters, A. H.,	-	-	Johnstown, Pa.
Ward, W. H.,	-	-	Easton, Pa.
Warmington, G. H.,	-	-	Cleveland, O.
Watson, C.,	-	-	Camden, N. J.
Watt, Anthony,	-	-	Connersville, Ind.
Weber, A.,	-	-	New York, N. Y.
Weber, O. B.,	-	-	New York, N. Y.
White, H. H.,	-	-	Portsmouth, Va.
White, W. H.,	-	-	New York, N. Y.
Whitehead, John,	-	-	New York, N. Y.
Wilcox, J. W.,	-	-	Macon, Ga.
Williams, E. H.,	-	-	Waterbury, Conn.
Williams, W. L.,	-	-	Paterson, N. J.
Wood, A. C.,	-	-	Syracuse, N. Y.
Zeek, C. F.,	-	-	Pensacola, Fla.

Associate Members.

Barrows, W. E.,	-	-	Philadelphia, Pa.
Coburn, C. M.,	-	-	Chelsea, Mass.
Cooke, H. G.,	-	-	New York, N. Y.
Crane, W. M.,	-	-	New York, N. Y.
Hayward, S. F.,	-	-	New York, N. Y.
Higgins, C. M.,	-	-	New York, N. Y.
Kelly, H. H.,	-	-	Waltham, Mass.
McDonald, D.,	-	-	Albany, N. Y.
Norton, H. A.,	-	-	Boston, Mass.
Osius, G.,	-	-	Detroit, Mich.
Page, A. L.,	-	-	New York, N. Y.
Persons, F. R.,	-	-	New York, N. Y.
Slocum, F. L.,	-	-	Pittsburgh, Pa.
Stratton, S. S.,	-	-	Chicago, Ill.
Wilbraham, J. S.,	-	-	Philadelphia, Pa.

THE PRESIDENT—The first business of the Association is the reading of the minutes of the last meeting. Will you have the minutes read?

MR. NEAL—As they have been already published in the Quarterly, I move that the reading of them be dispensed with.

MR. GATES—I second the motion. (Carried.)

APPLICATIONS FOR MEMBERSHIP.

THE PRESIDENT—The next business is the report of the Council on applications for membership. The Secretary will read the report.

The Secretary read the following report of the Council :

WASHINGTON, D. C., October 16th, 1894.

To the Members of the American Gas Light Association :

GENTLEMEN:—Your Council has approved the following applications for membership and submits them to the Association with the recommendation that they receive favorable action :

Active.

Charles F. Adams, President Portland Gas Company, Portland, Ore.

C. A. Byers, Consulting Engineer, Bristol Gas Lt. Co., Haverford, Pa.

John R. Coates, President Ottawa Gas Co., Ottawa, Canada.

James W. Dunbar, Superintendent New Albany Gas Light Co., New Albany, Ind.

John W. Eakin, Secretary Cairo City Gas Co., Cairo, Ills.

Richard S. Hicks, Secretary Rockville Gas and Electric Co., Stafford Springs, Conn.

Edwin G. Holzer, Sup't. Gas Dep't. Roanoke Gas and Water Co., Roanoke, Va.

W. A. Jeter, Vice-President Macon Gas Light and Water Co., Macon, Ga.

John Leetch, Gen. Manager Washington Gas Light Co., Washington, D. C.

John R. McLean, President Washington Gas Light Co., Washington, D. C.

R. L. Middleton, Superintendent Georgetown Gas Light Co., Georgetown, D. C.

Frank D. Moses, Superintendent Mutual Fuel Gas Co, Chicago, Ills.

George J. Roberts, Gas Engineer, United Gas Improvement Co., Philadelphia, Pa.

H. Z. Russell, Secretary and Treasurer Honesdale Gas Co., Honesdale, Pa.

Levi Stevens, Jr., Manager Gas Works, Heat, Light and Power Co., Trenton, N. J.

A. M. Voorhis, President Nyack Gas Light and Fuel Co., Nyack, N. Y.

H. D. Walbridge, Secretary and Treasurer Grand Rapids Gas Co., Grand Rapids, Mich.

Charles D. Woodruff, Chief Engineer Brookline Gas Light Co., Brookline, Mass.

Adolph F. Wehner, Treasurer Summit Gas Light Co., Summit, N. J.

Associate.

- Q. S. Backus, General Manager Backus Mfg. Co., Williamsport, Pa.
 F. Behrend, Clay Gas Retort Importer, New York, N. Y.
 Elbert P. Callender, American Gas Light Journal, New York, N. Y.
 D. J. Collins, Ass't Sales Agent United Gas Improvement Co., Philadelphia, Pa.
 James L. Hastings, General Sup't Nat'l Heat and Power Cons. Co., 138 South 6th street, Philadelphia, Pa.
 John H. Mansur, President Keystone Meter Co., Royersford, Pa.
 Henry A. Mather, Vice-President and Secretary Greenpoint Chemical Works, Brooklyn, N. Y.
 William W. Randolph, Gas Engineer Humphreys & Glasgow, New York, N. Y.
 W. H. Townsend, Oil Broker, 29 Broadway, New York, N. Y.
 Joseph D. Weeks, Editor American Manufacturer, Pittsburgh, Pa.
 Frederick A. Wilke, Mfr. Wilke China Kiln, Richmond, Ind.

Number of applicants—Active	19
“ “ Associate	11
Total	30

Respectfully submitted by the Council,

W. H. PEARSON, *President.*

A. B. SLATER, JR., *Secretary.*

MR. HARBISON—I move that the Secretary be authorized to cast the ballot for the election of these applicants.

MR. WOOD—I second the motion. (Carried.)

THE PRESIDENT—I will appoint Mr. H. B. Leach and Mr. A. B. Slater as tellers.

THE SECRETARY—Gentlemen: You have heard the names

of the applicants read by the Secretary as approved by the Council. If there be no objection I will cast the unanimous ballot of the Association for the election of the candidates to the respective grades of membership noted. Hearing no objection I so cast the ballot.

MR. LEACH—The committee have examined the ballot and find it unanimous for the election of the gentlemen named.

THE PRESIDENT—I shall be glad if all those gentlemen who have just been so unanimously elected will rise and stand on their feet so that we may see them and introduce them to this meeting. Gentlemen, we have very much pleasure in welcoming you to this Association, and hope you will find your connection with it to be both pleasant and profitable to you.

The next item of business is the report of the Council. The Secretary will read that report.

The Secretary read the following :

REPORT OF THE COUNCIL.

WASHINGTON, D. C., OCT. 16, 1894.

To the Members of the Association :

GENTLEMEN:—Your Council hereby report that the following papers have been approved to be read at this meeting:

1. "Observations on Sundry Methods of Making Water Gas from Bituminous Coal" (Vol. XI., No. 1, page 58), with Supplement (Vol. XI., No. 2, page 169), by Frederic Egner.

2. "Public Ownership of Gas Properties" (Vol. XI., No. 1, page 67), by Walton Clark.

3. "A Small Experimental Plant as an Aid to the Management of a Coal Gas Works" (Vol. XI., No. 2, page 118), by Peter Young.

4. "Some Experiences with the Welsbach Incandescent Gas Lamp" (Vol. XI., No. 2, page 121), by W. S. Rathell.

5. "One of the First Meter Makers in the United States" (Vol. XI., No. 2, page 130), by H. C. Slaney.

6. "Light Wasted in Bad Flames" (Vol. XI., No. 2, page 146), by N. W. Gifford.

7. "Applications of Chemical Technology to Gas Manufacture" (Vol. XI., No. 2, page 149), by Geo. H. Harper.

8. "The Use of Gas for Other Purposes than Lighting" (Vol. XI., No. 2, page 172), by Burdett Loomis.

9. "Taxation" (Vol. XI., No. 2, page 181), by Allen R. Foote (by request).

10. "Patching Holders while in Use" (Vol. XI., No. 2, page 194), by J. H. Findlay.

11. "Petroleum, Its Products and their Relation to the Gas Industry" (Vol. XI., No. 3), by Charles H. Evans.

The following have been appointed a committee to nominate officers for the ensuing year : Frederick H. Shelton, Chairman, David H. Geggie, Frank S. Richardson, George T. Thompson, James Somerville.

The Council also respectfully report that under Article V., Section 17 of the Constitution it has been decided that the only stenographic report of the Proceedings of the Association shall be that taken by the official stenographer.

Under the same section of the Constitution the Council have also established the following

BY-LAWS.

1. The annual payment by each member of \$5.00 as provided for in Article IX. of the Constitution shall be \$3.00 subscription for the Proceedings of the Association and \$2.00 to the General Fund.

2. At the end of each Association year the net cash balance standing to the credit of publication of Proceedings shall be turned into the General Fund.

The Council are sorry to be obliged to report the following named members as having been stricken from the Roll on account of non-payment of dues:

Active Members.

J. Frank Aldrich,	-	-	Chicago, Ills.
John W. Bates,	-	-	Hoboken, N. J.
Frank Bierce,	-	-	Austin, Tex.
Arthur F. Cooper,	-	-	Exeter, N. H.
T. G. Foster,	-	-	Montgomery, Ala.

S. Lewis Jones, - - - Philadelphia, Pa.
 Wm. J. Winegar, , - - Palatka, Fla.
 H. D. Wagner, - - - Philadelphia, Pa.

Associate Member—Robert M. Sumner, Philadelphia, Pa.

The Council have also remitted the unpaid dues and accepted the resignations of

Active Member—J. F. Sriver, - - Montreal, Canada.

Associate Member—F. B. Rice, - New York, N. Y.

The Council desire particularly to call the attention of the members of the Association to the fact that, as manufacturers of gas apparatus and appliances are naturally the best posted men on such subjects, it is very desirable to have, and the Council desires specially to encourage, the writing and presentation of papers by such members at the meetings of the Association.

The Council also desires to call the attention of the members to the fact that the Secretary is, with the approval of the Council, endeavoring to form a library of gas literature for the Association, and the hearty co-operation of every member is specially recommended.

On account of the extremely small number of copies of Volume V. of the Proceedings, the Council has fixed the price of that volume at \$5.

At the meeting of the Association one year ago the recommendation of the Council that the Proceedings be published in quarterly form was approved by the Association, and during the past year the proceedings have been issued in that form, and so distributed to the members.

In order that the advance publication to the members of papers for the meetings might be protected for the Association the Secretary has had the same copyrighted, but it is to be understood that the copyright on any paper so covered is, after the same has been presented to and discussed by the Association at its meetings, vested in the author of the paper.

In view of the fact that our Proceedings as published by the Association are a part of the benefits of membership, for which

each member pays an annual sum, it is understood that the Proceedings as so published are more particularly for the benefit of the members than of the community at large, and the Council have decided that under By-Law I. and Article IX., Section 51 of the Constitution, each member in good standing is to receive a copy of each issue of the Proceedings as published, and that he may obtain from the Association, by purchase, one extra copy.

The Council have fixed the price of such extra copies, and the price at which a non-member may obtain a single copy of each volume at seven dollars per annum.

The Council, after due deliberation and discussion, established a minimum schedule of prices at which advertisements would be received and published upon the last pages of each issue of the Proceedings.

In the publication of the Quarterly Proceedings it is understood that any matter published other than the papers written for and the reports of the Proceedings of the Association shall be limited to such statistical and reference matter as the Council may deem to be of value to the members.

Respectfully submitted for the Council,

W. H. PEARSON, *President.*

A. B. SLATER, JR., *Secretary.*

MR. BROWN—Do I understand the number of copies of the report of the Proceedings which members may purchase to be limited to one extra copy?

THE SECRETARY—Yes.

MR. HARBISON—I move that the report of the Council be accepted, and its recommendations adopted.

MR. STINESS—I second the motion. (Carried.)

THE PRESIDENT—The next business is the reports of the Secretary and Treasurer, which will now be read.

The Secretary read the following reports, which were, on motion of Mr. White, seconded by Mr. Leach, received and ordered placed on file.

REPORT OF SECRETARY FOR YEAR ENDING SEPT. 30, 1894.

Roll.—Honorary Members.

On Roll October 1, 1893..	5
No change during the year; on Roll Sept. 30, 1894.... .	5

Active Members.

On Roll Oct. 1, 1893.....	377
Elected Oct. 18, 1893.....	11
Failed to qualify.....	1
Died during the year.....	5
Dropped for non-payment.. . . .	8
Resigned.....	2
	388 less 16 = 372

Associate Members.

On Roll Oct. 1, 1893.....	46
Elected Oct. 18, 1893.....	6
Dropped for non-payment.....	1
Resigned.....	1
	52 less 2 = 50

Total now on Roll 427

FAILED TO QUALIFY, 1893-4.

Geo. W. Harrison..... Active..... Ashland, Wis.

DIED, 1893-4. (ALL ACTIVE.)

Frank H. Dyer.... Salt Lake City, Utah... March, 1893.
 Thomas C. Hopper.... Philadelphia, Pa. Feb. 23, 1894.
 John H. Knowles..... Richmond, Va..... May 5, 1894.
 Paul S. Merrifield..... New York, N. Y. May 12, 1894.
 F. A. Sabbaton..... Troy, N. Y..... April 14, 1894.

DROPPED FOR NON-PAYMENT OCT. 18, 1893.

Active.

J. Simpson Africa	Huntingdon, Pa.
A. H. Barrett.....	Louisville, Ky.
P. Bauer.....	Belleville, Ill.
John Read.....	Stratford, Ont.
Wm. E. Simpkin.....	Richmond, Va.
E. Stein.....	Philadelphia, Pa.
Jas. H. Walker.....	Milwaukee, Wis.
Geo. M. Ward.....	New York, N. Y.

Associate.

R. D. Walsh.....	St. Louis, Mo.
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RESIGNED.

Active.

P. T. Burtis.....	Phenix, Ariz ...	Sept. 29, 1894.
Hiram Merrill.....	Janesville, Wis ...	Aug. 16, 1894.

Associate.

W. S. Essick.....	Royersford, Pa.....	Oct. 18, 1893.
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Respectfully submitted by

A. B. SLATER, JR., *Secretary.*

REPORT OF TREASURER FOR YEAR ENDING SEPT. 30, 1894.

Receipts.

Dues for year 1891.....	\$5 00
“ 1892.	15 00
“ 1893.....	145 00
“ 1894.....	1,690 00
“ 1895.	30 00
	————— \$1,885 00
Membership fees, members elected Oct. 18, 1893. . .	150 00
“ “ in advance for Oct. 17, 1894.	10 00
Sale of Procéedings.....	44 25

Report of 21st Annual Meeting (A. G. L. J.).....	36 77
Interest on bank deposit	55 82
Advertisements in Quarterly Proceedings.	80 00
	\$2,261 84
Cash balance from last year.....	713 36
Total to account for.....	\$2,975 20

Expenditures.

Report of 21st Annual Meeting.	\$171 80
Expense " " Secretary's	74 00
Papers " " printing.	232 15
Publishing Proceedings, including cuts, etc.	814 15
Distributing Proceedings, postage.	81 40
Duty on foreign books received.	1 50
Council meeting May 15, 1894, report of and Secretary's expenses.....	86 27
Stationery.	20 58
Telegrams.	23 04
Postage, stamps and stamped envelopes.....	130 77
Printing, circulars, return cards, envelopes, etc.	62 90
Salary of Secretary and Treasurer.....	600 00
25 gold badges for new members.....	92 50
Storage of books (Proceedings).....	1 00
Railroad agent to attend 22d Annual Meeting	11 00
	\$2,403 06
Cash balance to carry to next year	572 14
Total accounted for.....	\$2,975 20

Accounts Receivable.

Dues for 1892.....	\$40 00
" 1893.....	215 00
" 1894.	405 00
	\$660 00
Advertisements in Quarterly Proceedings.	242 50
Total	\$902 50

(Bills for last item above have not yet been rendered)

Accounts Payable.

Publishing Proceedings, Vol. XI., No. 2, about.....	\$230 00
25 gold badges for new members.....	92 50
Total.....	\$322 50

Respectfully submitted by

A. B. SLATER, JR., *Treasurer.*

REPORT OF FINANCE COMMITTEE, OCTOBER, 1894.

WASHINGTON, D. C., October 16th, 1894.

To the Council:

Your Finance Committee has examined the books and vouchers of the Secretary and Treasurer, A. B. Slater, Jr., for the year ending Sept. 30, 1894, and found the same to be correct.

WALTON CLARK,
C. J. R. HUMPHREYS,
E. G. COWDERY,

Finance Committee.

THE PRESIDENT—The next business will be the reports of special committees. The Federation Committee, I may say, will not be ready to report until after the discussion of the papers to-morrow, as the Committee will have to meet again. We will now have the report of the Nominating Committee. The chairman of that committee is Mr. F. H. Shelton.

MR. SHELTON—As chairman of that committee I have the honor to report the following names unanimously determined upon by that committee:

For President—Walton Clark, Philadelphia, Pa.

In the consideration of Vice-Presidents what they call an emergency case has come up. One Vice-President is usually advanced one step each year, but that practice has been interrupted this year by the fact that Mr. A. W. Littleton, who has been our Second Vice-President, has positively and emphatically declined to serve—very much to the regret of the committee, and, I am sure, of the members at large. The committee

labored with him—not only myself as chairman, but the other members also; but it seems that Mr. Littleton will not agree to stand, and we must accept his declination. So that instead of one new name being added to the list of Vice-Presidents this year there will be two names added. It also means that the remaining Vice-President, by the removal of Mr. Clark and Mr. Littleton, will be moved two steps instead of being moved one step. The names as determined upon by the committee, by reason of that are as follows:

For First Vice-President—C. J. R. Humphreys, Lawrence, Mass.

Second Vice-President—Irvin Butterworth, Columbus, Ohio.

And the gentleman who has been selected in this emergency case, due to the stress of circumstances and under which we are most exceedingly pleased to be so situated as to be able to do so, is one of the oldest, staunchest and most loyal members of the Association, and I am sure a member the Association will be glad to have—

For Third Vice-President—Samuel G. Stiness, Pawtucket, R. I.

For Secretary and Treasurer—A. B. Slater, Jr., Providence, R. I.

For Members of Council to Serve for Two Years—A. C. Humphreys, New York, N. Y.; George G. Ramsdell, Philadelphia, Pa.; Jerome Croul, Detroit, Mich.; A. E. Forstall, Newark, N. J.

The above names were unanimously recommended by the committee.

THE PRESIDENT—You have heard the nominations. What is your pleasure?

MR. WM. HENRY WHITE—I move that the report be received and the committee discharged with thanks.

MR. LITTLEHALES—I second the motion. (Carried.)

MR. WHITE—I move that the list as prepared by the committee be received and placed on record, and that Mr. Harbison cast the ballot of the Association for the nominees.

MR. LITTLEHALES—I second the motion. (Carried.)

THE PRESIDENT—I will appoint Mr. C. F. Prichard and Mr. Thos. Littlehales as tellers.

MR. HARBISON—Gentlemen, I have the pleasure of casting your ballot for the gentlemen whose names have been read.

MR. PRICHARD—The tellers have received the ballot, and report that it is unanimously in favor of the list as read.

THE PRESIDENT—I have pleasure in announcing that the following gentlemen have been elected your officers for the coming year:

President—Walton Clark, Philadelphia, Pa.

First Vice-President—C. J. R. Humphreys, Lawrence, Mass.

Second Vice-President—Irvin Butterworth, Columbus, Ohio.

Third Vice-President—Samuel G. Stiness, Pawtucket, R. I.

Secretary and Treasurer—A. B. Slater, Jr., Providence, R. I.

Members of Council—G. G. Ramsdell, Philadelphia, Pa.; A. C. Humphreys, New York, N. Y.; Jerome Croul, Detroit, Mich.; A. E. Forstall, Newark, N. J.

Will the President-elect, Mr. Walton Clark, kindly come to the platform? We would like to hear from him. I congratulate you, Mr. Clark, upon your election.

MR. CLARK—Mr. President and Gentlemen: When, ten years ago in this city of Washington I joined the American Gas Light Association, I conceived an ambition which was entirely independent from office holding. After listening to the papers then read I hoped I might some day have something to say that the American Gas Light Association would care to listen to, and that I would have the nerve to say it. I can only congratulate myself on having acquired that nerve. Since then you have honored me for seven years with a place in your Council; and now, by making me your President, you have filled full and pressed down the measure of any ambition I may have had in connection with the gas industry. I thank you for it, and will endeavor during the next twelve months to deport myself consistently with the dignity you have this day conferred upon me.

THE PRESIDENT—If Mr. C. J. R. Humphreys is here we shall feel obliged if he will come to the platform.

MR. HUMPHREYS—Mr. President and Gentlemen of the Association: My excuse for not making any extended remarks this morning is that I know we have a very large amount of business to come before the meeting at this time, and so I will not do more now than thank you very heartily for the honor you have conferred upon me ; and I assure you that I think it a very great honor to be one of your Vice-Presidents.

THE PRESIDENT—Mr. Butterworth, our Second Vice-President, is not here. We shall be very glad to hear from Mr. Stiness, our Third Vice-President.

MR. STINESS—Mr. President and Gentlemen: As our good friend, the First Vice-President, has said, I esteem it an honor to be even a member of this Association of gas men, and to be made an office bearer among the very elect of heaven is an honor which I sincerely appreciate. I thank you most heartily for this token of your esteem and kindness. I have been a member of this Association for many years, and my earnest prayer is that I may long continue.

THE PRESIDENT—We shall be glad to have a word from our worthy Secretary.

MR. SLATER—Mr. President and Gentlemen of the Association: I very much appreciate your expression of confidence in the Secretary in re-electing him to the office he has now held for three years. I hope you will not be sorry for it. He will try to do the best he can for the interests of the Association. If he fails, he is willing to take his share of the blame for the failure. Gentlemen, I thank you for your kindness.

MR. THOMPSON—I understand that our second Vice-President, Mr. Butterworth, is detained at home and prevented from attending our meeting by a painful illness. I move that a telegram be sent to him, announcing his election to office, and expressing hope for his immediate and complete recovery.

THE PRESIDENT—We are very sorry to hear of his illness.

MR. LITTLEHALES—I second the motion. (Carried.)

The Secretary subsequently sent the following telegram:

WASHINGTON, D. C., OCT. 17, 1894.

Irvin Butterworth, Columbus, Ohio:

The American Gas Light Association has this day elected you Second Vice-President, and sends best wishes for your immediate and complete restoration to good health.

A. B. SLATER, JR., *Secretary.*

MR. GRAEFF—Would it not be a graceful thing on the part of the Association to pass a resolution thanking Mr. Littleton for the services he has already rendered to us, and expressing our regret that he will not continue in our service?

THE PRESIDENT—It is quite in order. Do you make such motion?

MR. GRAEFF—I make that motion.

MR. RAMSDELL—I second it.

THE PRESIDENT—It is moved by Mr. Graeff, seconded by Mr. Ramsdell, that a resolution of thanks of this Association be presented to Mr. Littleton, expressive of our high appreciation of the services he has rendered the Association as one of its Vice-Presidents, and of our regret that he declines to continue in office. (Carried.)

The Secretary subsequently had prepared and sent to Mr. Littleton the following:

The American Gas Light Association in its twenty-second annual assembly, on October 17th, 1894, has unanimously voted that it is with great regret and reluctance that it receives the positive declination of Mr. A. W. Littleton to further occupy official position as one of its representatives, and it hereby sincerely thanks him for his appreciated past services as a member of its Council and Third Vice-President.

Attest:

A. B. SLATER, JR., *Secretary.*

The Secretary read invitations to visit exhibitions of gas appliances in the city of Washington by Luther & Lederhos, of New York, and by the Backus Mfg. Co., of Williamsport, Pa., also the Welsbach Light Co., of Gloucester City, N. J., and the plant of the Maryland Meter Manufacturing Company in the city of Baltimore.

MR. NEAL—It has been customary to pass a vote inviting gentlemen connected with the gas industry who are present in the city, but are not members of the Association, to take seats with us. I suppose that would include the gentlemen who are in the Patent Office, and whose special vocation it is to examine patents upon gas apparatus.

THE PRESIDENT—It is not necessary to move a resolution. Such an invitation is so generally understood that it will not be necessary to put the motion. The next item of business is the President's Address, which, with the assistance of your kind attention, I will now read :

PRESIDENT'S ADDRESS.

Gentlemen of the American Gas Light Association :

A decade has passed since we last met in this beautiful Capital of the United States, and there are not a few present to-day, who have most pleasant recollections of the hospitable manner in which we were then entertained. Commingled with these pleasant recollections is the feeling of sorrow that our honored and valued friend, George A. McIlhenny, whose name is still a household word among the gas men of America, and who did so much to render our former visit enjoyable, has passed forever from this scene of action.

Since we last met here, many matters of great importance, affecting the interest of our industry have occurred. Electric lighting, then in its infancy, has made most marvelous strides, and so rapid has been its progress that at one time fears were rife that gas, as an illuminant, would, to a large extent, be superseded ; but, happily, so far from such fears having been realized, gaslighting—from a combination of circumstances, and largely on account of the demand for more light, caused by the introduction of arc lighting—has during the last decade increased at probably a greater ratio than during any decade since its introduction, while the consumption of gas for fuel purposes has gone up by leaps and bounds.

A glance at the progress of the gas industry, since our last meeting, will be in place. During a year of almost unprece-

dented financial depression, such as the past has been, when almost every industry has suffered, when so great a diminution in the volume of business has taken place, and disaster has overtaken so many, it would not have been cause for wonder had a reduction, both in the output of gas and in the profits of the companies generally, occurred: but, from the reports available, it appears evident that such has not been the case, and that instead of retrogression having taken place, on the whole, substantial advance has been made. Through the courtesy of Mr. F. E. Barker, Chairman of the Board of Gas and Electric Light Commissioners of Massachusetts, who has furnished me with the figures for that State, and of Mr. E. C. Brown, who has kindly sent me proof sheets of his directory for the present year, I am able to state that, taking 90 companies, large, medium and small, fairly representing the different localities in the United States and Canada, there has been an increase in the output during the past as compared with the preceding year, of 975,565,000 cubic feet, or 2.75 per cent., there being no reported increase in the population.

It is somewhat unfortunate that, owing to lack of information, a comparison of profits cannot be made with regard to the companies generally; but as far as the State of Massachusetts is concerned the information is available, and the results shown there may be considered fairly indicative of what has taken place throughout the whole country. It is pleasing to note that in Massachusetts the average dividends of 43 companies, supplying gas only, increased from 6.32 per cent. in 1893, to 7.53 per cent. in 1894, which is the highest average since 1886, when the statements were first published, and when the rate was 7.58 per cent. An enquiry naturally arises as to the reason for such results as those shown in Massachusetts, and the general increase in the output of gas throughout the country. I think the answer is not far to seek. Lower prices have in many instances prevailed, and gas of higher illuminating power has been supplied. In other words, a better and cheaper service has been afforded the public. Certainly, people are more economical in hard times than in prosperous ones, and the increased output looks like a recognition, on the part of the public, of the superiority and economy of gas, both for lighting and

heating purposes ; and, at least as far as Massachusetts is concerned, the results referred to have been secured concurrently with an increase in profits. No doubt an important element in securing this result, has been a decrease in the cost of production. Here I am led to refer to the large reductions in price that have taken place since the year 1882, when the first record of prices was published by Mr. Goodwin in his directory. In that year the average price of gas, in the 90 places referred to, was \$2.41 per thousand, while in 1894 it is \$1.38, a reduction of \$1.03, amounting in the aggregate, on the output for 1894, to \$37,510,530, or 42.7 per cent. The reduction from 1893 to 1894, amounted to 6 1-8 per cent. I think we may safely say that the days of exorbitant charges for gas have, happily, passed, and that never again will it be possible, for companies in large cities to charge from \$2.50 to \$3.00 per thousand, as was the case not so very many years ago.

Comparisons frequently made between the present prices in America and England are always unfavorable to the former. While admitting that these comparisons are sometimes unfair, and that due consideration is not given to the fact of the greater cost of works, the higher rate of interest payable when most of the works were erected, and the fact of the higher candle power of the gas supplied here, yet it cannot be denied that in some places there is still room for considerable reduction in price. It is to be regretted that these reductions are rendered difficult, in some instances, by a capital and bonded debt altogether out of proportion to the value of the works.

The question of public ownership of gas properties continues to be a live one, and as we have an excellent paper upon the subject, (written by the First Vice-President, Mr. Walton Clark), for our consideration at this meeting, it would be out of place for me to go into it at any length, or to go over ground covered by him. There is one point, however, not referred to by Mr. Clark, to which I think it well to call your attention, and that is the claimed success of municipal ownership in Great Britain, Germany and other European countries, being made an argument for municipal ownership in America. And here it might be remarked that the impression has gone abroad that a very large number of British gas works are under municipal control.

This opinion is erroneous, as I find, from the "Gas, Water and Electric Light Companies' Directory" for the present year, that out of 1,318 gas undertakings in Great Britain and Ireland, but 165, or about 12 1-2 per cent. are under municipal control; 119 out of 947 being in England, and but 5 out of 80, in Ireland. While it must be admitted that in England the works operated by municipalities are generally as successfully and efficiently operated as those controlled by private companies, the differences in the condition of affairs existing in Great Britain and America have not had sufficient consideration. In Great Britain is to be found a large, leisure class of retired merchants and men of business, who take a deep interest in advancing the welfare of their municipalities, and the civic spirit so prevails that there is an emulation between many of the larger cities in their efforts to be the best governed cities. The same can be said of Germany, where, generally, the aldermen are citizens of high character and ability, and the position being looked upon as one of great honor is sought after by the best citizens; but here in America the position of an alderman is generally looked upon by this class as undesirable and derogatory to them and there is a lamentable disposition, on their part, to evade civic responsibilities. It is, therefore, difficult, to get really good and efficient men to enter our town or city councils, and it will not be disputed that many of the men elected to look after the large and important interests of our cities would not be placed in positions of trust and responsibility in the financial and mercantile world. That there are some good men, is unquestionable; but in many cases the other element is too strong to allow them to accomplish the good work they would be only too willing to perform. Is it then to be wondered at, as Mr. Clark shows in his paper, that, as yet, municipal ownership in America has proved a failure?

The tendency to deprive companies conducting quasi-public works of their vested rights, and to practically confiscate their property, is becoming more marked as time progresses, and it will eventually shake all confidence in these undertakings if periodical raids are to be made upon their treasuries. That, in some instances, companies by their exorbitant prices and indifference to the requirements of the public have brought them-

selves into disfavor is not to be questioned ; but in the vast majority of cases the companies have met the public demands in a fair and equitable spirit, and no reasonable ground for complaint exists. This clamor to deprive companies of their just rights often proceeds from municipal bodies, largely composed of men who, by the cry against "bloated monopolies," seek to curry favor with their constituents in the hope of obtaining for themselves that patronage and other advantages which the control of such undertakings would give them ; and it is to be regretted that in some instances these men have been successful in accomplishing their ends. Newspapers, too, create ill-feeling by their bitter attacks, misrepresentations and untruths. These attacks are usually made by irresponsible men, whose object is not far to seek.

How to meet and overcome these attempts is a matter of deepest moment to all gas companies and is worthy of our most serious thought. The first consideration is for each gas company to do away with all just ground for complaint by charging reasonable prices, by supplying a uniformly good quality of light, by unvarying attention and consideration to the wants of the consumers, and by seeing that all are treated with courtesy by every employé. Greater satisfaction and public confidence could be secured by the appointment of government inspectors—to whom appeals could be made—for each place where gas is sold, and by the establishment by the State or Federal government of a standard of purity and illuminating power.

When conflicts arise between the public and the companies there should be, if possible, an independent tribunal to whom all matters can be referred. To my mind, and as suggested in President Boardman's address last year, a commission should be appointed by the Governor in Council, similar to the one in existence in the Commonwealth of Massachusetts—which, after several years' trial, has, I understand, proved so successful, and has given such general satisfaction to both companies and the public. I think, however, it would be more desirable that the Commissioners, instead of being appointed for a term of years, should be appointed for life, only being liable to dismissal, in case of inefficiency or misconduct—as is the case in Canada, with regard to all government officials of lower grade than cabi-

net ministers. Such a tribunal would be the most independent that could be found. How to secure the appointment of such a commission is a subject for careful consideration, and will doubtless render necessary concerted action on the part of the various companies in each State. Perhaps the matter has not reached an acute enough stage to require immediate action, but, doubtless, further acts of injustice on the part of the authorities will bring it to a focus. I am sure that when the time comes valuable counsel can be obtained from the representatives of the gas companies of Massachusetts.

The strenuous opposition to water gas, in the early years of its history, on the part of the majority of the coal gas engineers, will be remembered by not a few now present, some of whom were then doubtless to be found in the ranks of its opponents. It is amusing, at this date, to look back at the various reasons that were given at the time to show that water gas had never succeeded, and never could succeed or compete with coal gas, and no allopathic physician could have ever looked with more contempt upon another system of medicine than did the orthodox coal gas engineer regard this innovation at its early inception. As amongst the early advocates of water gas, and as, I believe, the pioneer in manufacturing and supplying it mixed with coal gas (which mixture I believe to give the most satisfactory light) and having incurred considerable odium and brought down upon my devoted head the strong censure of some prominent and esteemed members of this Association in the early days, I, of course, cannot but feel a good deal of satisfaction at the continued and rapid progress of water gas from year to year; and the gratification is enhanced by the fact that nearly all of my old opponents who are still in the gas-making business have fallen into line. A brief reference to its progress may not be out of place. In the year 1878, there were, as far as I can ascertain, in the United States and Canada, but 11 companies manufacturing water gas, viz.: Utica and Yonkers, N. Y., Harrisburgh, Lancaster, Manayunk, Phoenixville and Conshohocken in Pennsylvania, and Baltimore, Md., in the United States; and Brockville, Kingston and Toronto in Canada. These, according to Goodwin's Directory, had increased to 66 in 1882, and according to Brown's Directory, in 1893, to 269 making water

gas alone, and 87 making both coal and water gas. In all, 356 out of a total of 1,079 companies. As most of the larger companies are supplying either water gas alone, or both kinds of gas, it is estimated that nearly two-thirds of the gas manufactured in America is water gas. Here I might remark that 42 of the companies whose names appear in Brown's Directory for last year have failed even to report so simple a matter as the kind of gas supplied. Why so easily stated and uncompromising an item should be withheld is hard to say. Omissions to supply one or more of the items asked for are common. This is much to be regretted, as the information would make this useful directory much more valuable than it is. The meagre reports given, in some instances, are in marked contrast to the reports in the English directories, which are most complete. Doubtless the reason for withholding these reports is the fear that the information might be used injuriously to the companies. I think that this fear is entirely groundless, and it is much to be desired that the companies withholding information will reverse their decisions hereafter.

Through the instrumentality of Messrs. Humphreys and Glasgow, whose energy and push are worthy of admiration, water gas seems to have at last obtained a foothold in Great Britain. Apart from the natural indisposition of Englishmen to adopt anything new, the objections made to the use of the gas, on account of its carbonic monoxide, high specific gravity, shortness of flame, stratification in the holders, etc., similar to those raised and successfully met in America 12 or 14 years ago, there was what seemed to be a strong reason operating to prevent the introduction of the new system, viz., the long distance from the petroleum fields and the comparatively high price of oil. However, in 1891, the first works were erected at Beckton, and subsequently others were built at Glasgow, Belfast, Liverpool and Tottenham; also, on the Continent, at Copenhagen and Brussels. Mr. J. Stelfox, Engineer of the Belfast Company, in a paper read before the Gas Institute, at Westminster, in June last, speaks enthusiastically of the success of the plant erected for his company. He sums up as follows: "1st—That carbureted water gas of 21 candle power can be produced for less money than 17 candle coal and cannel gas, and this, without

taking into consideration the saving in interest on capital and the increased revenue from coke, not to speak of the many advantages and conveniences to which I have not ventured to attach a money value. 2d—That the enrichment of water gas, within the range of 17 to 26 candles, or even higher, can be effected at cost of not more than 0.33d per candle."

After referring to the superiority of carbureted gas over other systems which are merely enrichers of gas he concludes his able paper with these words :

"I believe carbureted water gas holds the field against all comers, and, given a supply of oil, at not exceeding present prices, it is bound to have a prosperous future."

The present prices referred to being $2\frac{1}{2}$ pence per Imperial gallon, equal to 4 cents per w. m. gallon.

With such testimony as that, and taking into consideration the fact that Great Britain enjoys the advantage of having two great competitive sources of oil supply—America and Russia—from which suitable oils can be obtained, in unlimited quantities, with the prospect of the demand causing a reduction in price, it is quite safe to predict, notwithstanding the opposition still existing in high quarters, that before long water gas will be very generally adopted in the old country.

As President Boardman in his address last year referred so fully to the advantages of the Welsbach burner, and as a paper on, "Some Experiences with the Lamp," is to be read at this meeting, I do not think it proper to say all that I otherwise might have said.

Since our last meeting the burner has been largely introduced in Great Britain and Germany, and is now beginning to make considerable headway in this country, some 30,000 having been placed in the city of Montreal alone. As we all know the great drawback to the introduction of the light is the fragile nature of the mantle, but the Canadian agent has informed me that the inventor is at work in the preparation of a durable mantle, which he has good hopes of securing, and which he expects at the same time will give double the candle power of the present one. If the anticipations of securing this increased illuminating power are realized, it will be a marvelous light, as I have seen the original certificates of tests, made by the Government

Gas Inspector at Montreal, showing 34.58 candles per foot of gas, and of tests made by the inspector at Kingston, Ont., showing 31.37 candles per foot; but I am strongly of the opinion, that there must be some mistake in these figures. I have had tests made in Toronto giving an average of 20 candles per foot. Of course these were new burners, and would, doubtless, somewhat deteriorate after being used for a time.

Some progress has also been made in the use of the Welsbach burner for street lighting. The *Gas World* of September 22d, reports Mr. R. S. Galloway to have stated, before the Waverley Association of Gas Managers, at Portobello, Scotland, that the street lighting of Nicholson Square, Edinburgh, was with these lamps burning 3 1-4 feet of gas per hour, the lighting being done by means of a by-pass, obviating the necessity of opening the lantern. In the *Journal of Gas Lighting* for June 19, 1894, there is an interesting and detailed account of experiments with these burners for street lighting, in Weisbaden, Germany, by Herr Muchall, manager of the gas company there. The burners were in use during the winters of 1892 and 1893, and the writer claims that, after paying for the chimneys, mantles, depreciation of burners, etc., the new system cost about the same as the old one, with an increased illuminating power of from 2 1-2 to 3 times greater than was afforded with the ordinary burners. The experiment to light Rittenhouse Square, Philadelphia, with double Welsbach lights, referred to in a recent number of *Light, Heat and Power*, will be watched with great interest by all gas men, as most of us have been of the opinion that the field of street lighting would be almost entirely occupied by the arc light. I have had some of the burners, consuming 2 3-4 feet of gas per hour—instead of 5 feet consumed by ordinary burners—placed in street lamps in Toronto, for the purpose of testing them during the coming fall and winter, with a view, should the test prove satisfactory—i. e., if the additional cost for mantles, breakages and lamplighting does not exceed the amount of gas saved—of offering them to the city, instead of lamps with ordinary burners, thereby giving them about three times the light for the same money.

The question as to whether gas companies shall recommend the general adoption of this burner at the risk of loss of con-

sumption, or continue to use the old ones, is a pertinent one ; but to my mind the wiser policy is to adopt the burner which will give the largest amount of light, for the least money, and in the long run, this policy will best pay the companies.

According to Herr von Oechelhauser, General Director of the German Continental Gas Company, it appears that America is vastly behind Germany in the development and working of gas engines, as in the former country there is but one engine to 7,500 of population, while in Germany, in 1892, there was one for every 900 of the population, the statement regarding the number per capita in use in America, probably being taken from Mr. Shelton's paper on "Gas Engines in the United States,"* and he gives as the cause of the small number in the United States, that they cost more than steam engines, while in Germany they cost less. In giving this as the reason, however, he is in error, for undoubtedly the strongest competitor of the gas engine in America is the electric motor.

I have been fully alive to the importance of the use of gas engines, and the cost of imported engines, owing to freight and duty being then prohibitory in the year 1880, my company, by agreeing to take a certain number, induced a Toronto machinist to undertake the manufacture of the "Otto" engine, and these were sold at a much lower price than they could have been imported for. With considerable effort I was successful in getting about 70 introduced, in two or three years, of sizes varying from 2 to 12 horse power, but since the introduction of electric motors the number has not increased. As elsewhere, the charges of the electric light companies in Toronto, for power, are elastic. Their ordinary rate, however, is 4 cents per horse power per hour, while gas engines, with gas at our price—90 cents—cost only about 1.80 cents per horse power. The principal cause of the preference for electric motors is the small first outlay, being only one-third to one-half the cost of gas engines, as the following list of prices will show, and the fact that electric motors are leased at a moderate rental.

Net prices in Toronto of gas engines: 2 horse power, \$350; 4 horse power, \$450; 7 horse power, \$600; 10 horse power, \$775.

*See Vol. X, No. 2, Page 232, Appendix, Page 29.

These were about the average prices in the United States some time since. I have, however, recently received quotations from a firm giving considerably lower figures.

Net prices in Toronto of electric motors: $\frac{1}{2}$ horse power, \$65; 1 horse power, \$85; 2 horse power, \$110; 3 horse power, \$150; 4 horse power, \$175; 5 horse power, \$200; 6 horse power, \$250; 8 horse power, \$300; 9 horse power, \$350; 10 horse power, \$400; 11 horse power, \$450.

Unquestionably gas engines ought to cost considerably more than electric motors, but I do not think anyone will claim that there should be anything like the difference here shown, and it would be to the interest of both manufacturers and gas companies if the former would come down in their prices.

The adoption of gas engines for a greater variety of purposes than at present used for was discussed in the able paper of Mr. F. H. Shelton at the last meeting of the Association, and, amongst other uses, attention was directed to a field almost entirely unoccupied, namely, as gas motors for street car propulsion, and a description was given of the Connelly Motor, said to be in about the shape they wanted it. I have written to both the Connelly Motor Company, Chicago, and the Connelly Engine Company, New York, for information on the subject, but could not obtain information of further satisfactory progress.

This subject was also referred to by my predecessor in his address.

In a monograph on "Progress in Gas Motors for Street Railways," published in *Light, Heat and Power* for August, 1894, Mr. Frank H. Mason gives a description of the Luhrig car, with certain modifications, worked on the lines of the Tramway Company, at Croydon, near London, England, which appears to be a success. The statement is made that a motor car of that type was then being constructed (July last) in England to be carried to the United States for trial during the present month, but so far I have not seen a reference to it in any of the Journals.

It would seem not improbable that a new and large field will be found for our product in this direction.

Owing to the rapid increase in the number of electric street

railways, the subject of electrolytic corrosion of gas and water pipes, by return currents, has, naturally, attracted a good deal of consideration on the part of gas men and others, and an able paper, from Mr. I. H. Farnham, has been published in the July *Quarterly*¹ and will be before you for discussion. Last year the Western Gas Association appointed a committee to consider and report upon the subject. The committee presented an able and voluminous report² at the May meeting of their Association, and very valuable suggestions were made as to the best methods of preventing the injury referred to. As an item of interest I would say that the Toronto Street Railway Company has shown every disposition to take measures to prevent injury to gas and water pipes and lead-covered telephone cables from this source. The following precautions have been adopted: At a point near its power house, a copper band, 12 inches by one-eighth inch, is fastened around a 20-inch gas main, the pipe having been carefully scraped before the band was put on. After the band was placed, hot solder was poured on so as to leave no spaces between the pipe and the band. This band was well clamped together and bolted, and from it five half-inch copper wires have been taken to the negative side of the dynamos in the power house. Connections have also been made from a water pipe in the locality in a similar manner. At seven different points, within a radius of a mile, where the traffic is the greatest, half inch No. 0000 copper wires are connected from the water mains to the rails, and are carried back, overhead, to the dynamos, and they are about to increase the number of these connections. Besides, numerous connections have been made between the rails and water pipes—the rails are large, weighing 72 pounds to the yard, and are firmly imbedded in concrete, thus making the joint more secure. The railway has been operated by electricity for over two years, and, although numerous excavations have been made, both by the Gas Company and the Water Works Department of the city, so far, no electrolytic action upon the pipes of either has been detected; nor, as far as has been ascertained, has any injury resulted to the telephone com-

¹ See Vol. XI., No. 1, Page 29.

² See Vol. XI., No. 1, Page 49, for Reference Appendix.

pany whose wires are underground, enclosed in lead pipes in conduits. The railway company has had in use, during the past year, 120 motor cars, and I am informed that the current averaged 2,000 amperes.

Our record of membership shows that five more members of this Association have gone over to the silent majority. The first to pass away this year was Mr. Thomas C. Hopper, who died on February 23d. He was for many years Superintendent, and from 1877-1887 President of the American Meter Company, and a Trustee of that company to the close of his life. He had large interests in a number of gas works. Mr. Hopper joined this Association in the year 1876. My acquaintance with him dates back to 1878, and in my business intercourse with him I had ever found him kind, courteous and obliging; a man thoroughly up in all branches of his work. In a sense, his death is to me a personal loss, and I shall, with many of you, miss his presence at our meetings.

Mr. Frederic A. Sabbaton, President of the Whitehall and Glens Falls Companies and President and Engineer of the East Albany Gas Light Company, Troy, N. Y., died on April 14th. He was one of the older members of the Association, having joined in 1873. He was an able engineer and thorough man of business, and was highly esteemed in the community for his integrity and geniality.

Mr. John H. Knowles departed this life at Richmond, Va., on the 5th of May at the advanced age of 78. He became a member of the Association in 1879. He was gas inspector for the city for 11 years up to 1866. He was elected Superintendent of the City Gas Works in 1870, which position he retained until about 1886. His ability as a superintendent, his business capacity and energy and faithfulness in the discharge of his duties are highly spoken of, and he was much esteemed for his excellent qualities as a man.

Mr. Paul S. Merrifield, Secretary-Treasurer of the American Meter Company, who joined the Association in 1879, died in Brooklyn, on the 12th of May last, after a short illness. He was held in high estimation by his associates, and his loss will be mourned by all members of this Association who had the pleasure of his acquaintance.

Mr. Frank H. Dyer, Manager Salt Lake City (Utah) Gas Works, died March, 1893.

The Secretary only heard of his death about a month since, and has received no further particulars. He joined the Association in 1891.

Suitable obituary notices will hereafter be prepared by the Secretary.

It is pleasing to note that, notwithstanding the numerous Associations in existence, the membership of the American Gas Light Association has steadily increased from 340 in 1888 to 428 in 1893. However, it must be admitted that, with nearly 1,100 gas companies in the United States and Canada, a total membership, including associates, of 428 is by no means a fair representation. The large additions to the Association of members in early manhood, having the advantages of a technical education in the excellent schools, now becoming so common throughout the country—advantages which many of the older members did not possess—augurs well for the future of the Association, and to these younger members must we chiefly look to explore the inviting fields of investigation, for which their educational advantages and enthusiasm specially qualify them, and which their comparative leisure affords them opportunity for doing.

The publication of the *Quarterly Magazine*, containing not only the papers of members, to be read at the Association meetings, but papers and other items of interest from outside sources, lists of patents relating to gas, lists of gas light journals and classified indices of interesting articles in current literature, will doubtless be fully appreciated, and the publication in advance of the papers to be discussed at our meetings, affording ample time for their proper consideration, is obviously a very great advantage, and cannot but add greatly to the value of the discussions.

I should not be doing justice to our Secretary if I did not bear testimony to his marked ability, untiring energy and pains-taking industry. The Association is certainly fortunate in having a Secretary who, in addition to his other acquirements, is so well qualified to edit our Proceedings.

Now, gentlemen, I fear that I must ask your pardon for hav-

ing so long trespassed upon your patience. You have a number of admirable papers before you for consideration, and I trust the present meeting will rank amongst the best we have ever had.

THE PRESIDENT—It has been customary to appoint a committee on the President's Address. I do not know that I have made any suggestions of any particular worth; but following the custom I will appoint on that committee: John P. Harbison, E. G. Cowdery and A. B. Slater.

I will announce the nomination of the committee to select the next place of meeting. Immediately after the nomination is made I would like to have the gentlemen here suggest names of places for the next meeting in order that the committee may take them into consideration and report as early as possible as to the place. I will appoint on that committee: Walton Clark, the President-elect, J. P. Harbison, T. Littlehales, E. G. Cowdery and C. F. Prichard. To assist you in the selection the Secretary will read the list of places where the Association has already met that you may not go too often to one place.

THE SECRETARY—The meetings of the Association have been held at the following-named places: The initial meeting was held at Cleveland in September, 1872; the first regular in April, 1873, in New York; then October, 1873, New York; May, 1874, Cleveland; October, 1874, Brooklyn; May, 1875, Washington; October, 1875, New York; October, 1876, New York; October, 1877, Cincinnati; October, 1878, New York; October, 1879, Philadelphia; October, 1880, Chicago; October, 1881, Boston; October, 1882, Pittsburgh; October, 1883, New York; October, 1884, Washington; October, 1885, Cincinnati; October, 1886, Philadelphia; October, 1887, New York; October, 1888, Toronto; October, 1889, Baltimore; October, 1890, Savannah; October, 1891, New York; October, 1892, Boston; October, 1893, Chicago; October, 1894, Washington.

The following places were suggested by different members for the next meeting: New York, Hartford, Indianapolis, St. Louis, San Francisco, Denver.

MR. FAY—I hope the committee will name Denver as a suit-

able place of meeting, for I think that would be an elegant place. But, Mr. President, while I would be delighted to meet the members of the Association in Denver, I have a place to name which I think will please them better—the home of the old hero of water gas—Los Angeles, California.

MR. GRAEFF—I would like to supplement the invitation thus given to Los Angeles by stating that the prophet and apostle of water gas is to-day in Philadelphia, and expected to be here this morning, but feared it would be impossible. He promised that if he could not come he would send a message of condolence to one of his early pioneer societies. While Brother Fay knows that his invitation would be seconded by Professor Lowe, I will say that yesterday Professor Lowe desired me to state to the Association that if they would come west to California and meet in the city which is now his adopted home, he would give them such a glorious reception as this Association has never yet found—not even at Toronto.

MR. CLARK—No one has yet mentioned the quiet little city on the Delaware. I suggest Philadelphia for 1895.

MR. RUSSELL—I want to say that we would very much like to have the American Association come to St. Louis. They have never been there yet. We have hotels enough to hold them, would like very much to see them there, and hope they will come.

The Association took a recess until 2 p. m.

FIRST DAY—AFTERNOON SESSION—OCTOBER 17TH.

The Association was called to order at 2 p. m.

THE SECRETARY—Mr. President, I have here to present a report of the Council on its action in respect to a proposal for honorary membership which has been considered by the Council, and is unanimously recommended to the Association for favorable action. The proposal is as follows :

“ We, the undersigned, respectfully represent to this Council that Mr. Allen R. Foote, of Washington, D. C., has by his

writings and acts shown himself to be such a person as most properly should be affiliated with this Association under Section 8 of our Constitution, and hereby submit his name for election as an honorary member of the American Gas Light Association. As his interest in and efforts in behalf of the gas industry are so well and favorably known by the members of the Association, we believe it entirely unnecessary to present any evidence in support of our proposition."

This is reported unanimously by the Council, and now comes before the Association as a proposition of the Council.

MR. GRAEFF—I move that this report of the Council be received and its recommendation adopted. No man in this country is more thoroughly and deservedly entitled to the thanks of this Association than is Mr. Foote.

DR. AMORY—I second that motion.

THE PRESIDENT—It is moved by Mr. Graeff and seconded by Dr. Amory that the report of the Council recommending the election of Mr. Allen R. Foote to honorary membership be adopted. (Carried.)

THE PRESIDENT—Is the Committee on Place of Meeting ready to report?

MR. CLARK—Yes. The committee recommend that the 1895 meeting be held in the city of Philadelphia.

MR. JENKINS—I move that the recommendation be adopted.

MR. BUCKMAN—I second that motion. (Carried.)

THE PRESIDENT—I have received the following telegram :

" *To W. H. Pearson and Walton Clark, American Gas Light Association, Washington, D. C.:*

My heart is with you. Sorry I cannot attend in person. I extend greetings to you all.

T. S. C. LOWE."

Have we any message in reply to send to this venerable water gas man?

MR. GRAEFF—I move that the Secretary be instructed to wire back, "God bless you."

MR. BOARDMAN—I second the motion. (Carried.)

The Secretary subsequently wired as instructed.

THE PRESIDENT—The next item of business will be a paper by Mr. Walton Clark on the Public Ownership of Gas Properties. Is it your desire that this paper shall be read or taken as read? It has been already published in the Quarterly.

MR. CLARK—Permit me to say that there is not going to be time between now and to-morrow night to read thirteen papers and discuss them; and if the gentlemen have read these papers through it would be better to take them as read.

MR. THOMPSON—Inasmuch as Mr. Clark's paper has been published in the Quarterly I move that it be taken as read.

MR. SLATER—I second the motion. (Carried.)

THE PRESIDENT—Mr. Clark has given us a very able paper upon a very important subject. Doubtless many of you have thought it up; and we shall be glad if you will be prompt in your remarks, for there is a great deal yet to be done before we get through.

MR. THOMPSON—Of course Mr. Clark fully appreciates that there is no discourtesy intended to him by the motion that his paper be taken as read. I would like to ask him to tell us what difference there exists in the voting qualification between England and America. That is a consideration which bears upon one of the questions with respect to municipal organizations for commercial purposes.

MR. CLARK—I cannot answer that question. I do not know what the difference is in the voting qualifications between England and America.

MR. LITTLEHALES—I do not see that that touches the question very much. It seems to me that it is a question of capitalization rather than a question of taxation.

MR. McKEIGE—I have not had time to glance over this paper written by Mr. Clark. Perhaps there are others here who have

been very busy for the last few weeks and have not had time to read Mr. Clark's paper as carefully as they might. That has been my experience. Perhaps Mr. Clark will give us a summary of his paper so that we may discuss it more intelligently.

MR. LITTLEHALES—I think it will be found one of the drawbacks in taking papers as read, that we shall lose interest and lose the value of the discussion which often is a very important addition to the paper. However able a paper may be there are always two sides to the question presented; and hearing a paper read gives us the advantage of bringing out the other side.

THE SECRETARY—This paper was published in the July number of the Quarterly, so that the members have had three months to digest it; and it would be well for the members to distinctly understand that in the present method of publishing the Proceedings if a paper appears in one number of the Quarterly it is expected that all the members will read that paper carefully, digest it thoroughly, write out their discussions of the subject treated, and send them in to be published in the next issue of the Quarterly—if there be one previous to the meeting. Then the matter will be opened out most thoroughly for discussion at the meeting. It is intended by the present method of publishing the Proceedings to have first the paper, then a counter-paper, a supplement, and an appendix if you like; and in that way to have a subject threshed out in the Quarterly as thoroughly as possible before the meeting.

MR. BROWN—I will ask the Secretary about how soon we may expect to see the report of the Proceedings of this meeting in the Quarterly.

THE SECRETARY—It is expected that the report of this meeting will appear in the January number. The Quarterly is intended to be issued the first of January, April, July and October; and the next issue will be in January.

MR. JENKINS—It is quite evident that the intention of the Secretary in respect to this paper has not been carried out by all the members. I do not see very many memoranda which have been offered in the October Quarterly; nor have they been

brought here, as is very evident. I move that Mr. Clark's paper be read.

THE PRESIDENT—That matter has been already settled. It is supposed that the members will bring their Quarterlies with them to the meeting—after having read the papers and made their memoranda for discussion.

MR. JENKINS—It is very evident they have not done so.

THE PRESIDENT—That is not the fault of the Secretary.

MR. JENKINS—No; of course not.

MR. COGGSHALL—It is no fault of the Secretary; but I presume that not one-half of the members have brought this paper with them. I have forgotten mine. We have got to have the subject fresh in our minds by having the paper read as a way of opening the discussion. The discussion had on a paper is oftentimes quite as profitable as the paper itself. I move a reconsideration of the vote by which we decided not to have Mr. Clark's paper read.

MR. BOARDMAN—I second that motion. I was waiting very patiently for those who have read this paper and have prepared themselves to discuss it to rise to their feet (after the motion was carried to consider it as read) and go ahead and discuss it. But I have waited in vain. Those who have risen to their feet have been those who are frank enough to say that, while some have read it, others have not had time to do so, and that they would like to have their memories refreshed. Unfortunately my number of the Quarterly containing this paper has been hunting for me over the country for the last three months, and I have not really had time to see it. The subject treated by Mr. Clark in his paper is one which is really too important for us to take up without being thoroughly familiar with the paper, and refreshing our memories with regard to it. Mr. Clark is eminently qualified to add much to our information on this subject. It is a burning question with us, because, as I am sorry to say, the communistic tendency in municipalities is growing stronger every day; and unless we are thoroughly informed upon this all-important subject we may suffer. I hope this paper will be read for the information of those who have not read it, and

for the refreshing of the memory of those who have read it. Those who have read it and are ready to discuss it will be in no wise injured in their discussion by hearing it read again.

(The motion to reconsider was carried.)

MR. COGGSHALL—I move that the paper be read.

MR. JENKINS—I second that. (Carried.)

THE PRESIDENT—Mr. Clark will now have the kindness to come to the platform and read his paper.

*Mr. Clark then read his paper on

PUBLIC OWNERSHIP OF GAS PROPERTIES.

(See Vol. XI., No. 1, Page 67.)

THE PRESIDENT—You have listened to a very able paper, and it is now open for discussion.

MR. CLARK—I wish to state that I used the Wheeling figures for 1891 because I was unable to obtain any later report, although I have made several attempts directly and through others to get the reports. I wrote within the last month to Bellefontaine, Wheeling and Hamilton for reports from those municipal works, but received a reply from Bellefontaine only; and the information obtained was too meagre to enable me to make an analysis, although they claimed to make four per cent. on the value of their plant.

MR. BOARDMAN—In listening to that paper there were two points that struck me as being pertinent that might be added to the many valid reasons against the municipal ownership of gas works. In the first place, if a municipality owns the gas works it should be for the benefit of all the individuals composing the municipality. In every municipality there are a certain number who pay the general taxes, but who do not burn gas. If the municipality makes money upon its gas works by charging the consumers a certain amount for their gas, then it is making money out of the few who burn gas, or it may be the majority, but it is not all. Thus they make money out of those who burn gas for the benefit of those who do not. If, on the other hand, it charges less for the gas consumed than it costs to make the gas, it has to make up the deficit by general taxation. It seems to me that the only equitable way of managing gas works is to

manage them for the benefit of every consumer, but that the general public should be taken in as consuming, and the rate per thousand should be controlled per capita. In no other way, it seems to me, can an equitable division of the burden of municipal control be arrived at. In the next place, the municipal ownership of gas works might be countenanced if gas were the only source of illumination. But it is not. The strongest competitors which gas has are petroleum oil, burned in lamps, and electricity. The moment a municipality becomes the owner of a gas works it is jealous of the right to supply illumination to its inhabitants; and it handicaps the people from taking electricity, which some may prefer, or oil, which many may prefer. In other words, it uses its immense power to force the use of gas as an illuminant upon its people for the profit there is in it; and in that way the people are deprived of the natural and fair competition which a gas company has to encounter with other illuminants. In that way I think there is an injustice to the people at large. I can appreciate, as some of the rest of you can, that the municipal ownership of a water works is a question which has more on the side of the municipality; but in respect to gas works (as gas is only one of a number of illuminants) I do not think that municipal ownership should be allowed to hamper private enterprise. I think it is a danger and a harm to the general public when a municipality owns its gas works.

MR. JENKINS—If the city owns its own gas works then it should put that plant in such condition as to carry gas to every point in that city where there is a tax payer. The tax payer at the extreme end of the city, where there may be two miles of unoccupied street, has just as much right in that respect as the man who lives in the middle of the city.

MR. BOARDMAN—The gentleman is right, but his argument is not very strong—that it is an injustice to none but the tax payers.

MR. WILLIAMS—In Mr. Clark's paper there is one point that might be enlarged upon. He says, "A municipality may reasonably exact from the gas company valuable concessions in return for an insured exemption from gas competition." Following out this line I would suggest that the authorities should

protect the consumer by requiring the gas company to furnish a gas free from impurities, and of a standard illuminating quality at a fair price. They may have an inspector of the gas, and of gas meters, with all the implements for testing the gas and the gas meters properly. No company would object to having such an inspection made providing the inspector was a capable and conscientious man, and did the work thoroughly and honestly; not a ward politician, without any knowledge of the business, but who was simply a tax gatherer, and distributed his badges, without making any test whatever, to those who paid the largest fees. Then the authorities may appoint an inspector of all house piping and fixtures who should see that all gas piping was done in a proper manner, of a sufficient size for all the requirements, free from traps, and perfectly gas tight. The cost of this should be borne primarily by the house owner; one-half, or a fair proportion, to be paid by the gas company to the said owner upon the introduction of the gas and the surrender of the inspector's certificate. The authorities should protect the gas company from opposition gas companies by refusing to grant a franchise to more than one company, provided that one complied with the proper requirements. They should also protect the property of the gas company from injury by irresponsible or careless contractors for sewer or other excavations, by inserting in their contracts and permits for such work a clause to that effect, and require bonds for the faithful performance of the same. It is my opinion that if proper legislation were carried out on these lines the results would be better for both producer and consumer than for the authorities to attempt the manufacture and distribution of gas on their own account.

MR. LITTLEHALES—It seems to me, Mr. President, that the whole question is boiled down into a simple matter as to the difference at which the municipal corporation can borrow money and that which is paid by the gas company in dividends. For the sake of the argument assume that the municipality can borrow money at four per cent., and assume for the sake of the argument that the average dividend paid by the company is eight per cent.: that would mean that they would save four per cent. interest on their capital. Now we are to set off as against

that the loss that will arise to the municipality from the lack of continuity in the management; and that is a very serious loss. However intelligently an aldermanic body may manage its affairs, and however honest it may be in its work, still the body is a changeable organization; and from year to year one committee undoes what a former committee has done. I have occurring to my mind just at the moment an incident bearing that out which occurred in a city that I know of, where one committee started out on a public experiment of great advantage, which was rather a risky undertaking, and possibly a little in advance of the time; but they spent about half a million of dollars in the effort to push the thing through. The next committee, coming in the year afterwards, said that the former committee must have been crazy; this is too big a thing for us; we must shut down on it. The third year another committee comes in and says: If this last committee had only had sense enough to have continued what the first committee began, we would have had a great public improvement. They tried to go back and continue the work of the first committee. And so, from year to year, money was sunk until about a million dollars had been expended, and no desirable result following it. Now, follow that same plan in a gas committee (even assuming that the gas committee was everything that could be desired) and you will find that the lack of continuity is going to be a very serious loss—far more than four per cent. per annum. The board of directors of the gas company continuing in authority from year to year can look ahead and steer the business accordingly. I think that is a feature of municipal control that Mr. Clark somewhat overlooked. It is a very important one. I take the view of Mr. Clark, that if a municipality owns the gas works there is no justification for doing anything more than charge a price for gas sufficient to pay a fair interest on the capital invested—simply that, and nothing more; and the gas should be sold at as nearly cost price as will cover that.

MR. HARPER—We may look for information in this matter to England and Scotland. I am familiar with the operation of municipal plants in Manchester, England, and Edinburgh, Glasgow, and Aberdeen, in Scotland; there they are supplying

both gas and electric light; each being charged for at a price that will pay the cost of manufacture, and a fair interest on the investment, and leaving to the consumer of either the electric light or gas light to express his preference in the matter. Mr. Littlehales might have answered that (drawing information from the same source) by saying that the general management by municipalities of gas works in Great Britain and Ireland is always a continuity of management, inasmuch as the committee do not all retire in one year, but only a certain proportion of the membership, and the rest of them remain, and in the light of their experience and greater information can always guide the deliberation of the committee.

MR. BOARDMAN—As Mr. Harper is familiar with the results of municipal ownership abroad I would like to ask him this question: Do the gas companies in the cities he has mentioned make a profit on their undertakings; or do they make a loss? And, in either event, what is the profit, if any is derived, applied to; and how is the loss made up?

MR. HARPER—In reply I would cite just one instance. The city of Manchester a few years ago, when prices of residuals were so high, made a profit from gas manufacture of something like fifty-two thousand pounds per annum; and the money was applied to public improvements. At the present time I think the profits are cut down to something like half that sum, but those profits are still devoted to public improvements.

MR. BOARDMAN—That merely goes to emphasize my argument that the sum of fifty-two thousand pounds, plus the cost of the light for the whole city of Manchester, was taken out of the pockets of those who burned the gas.

MR. LITTLEHALES—The fact that the members of the committee hold office for two or three years somewhat obviates the difficulty. This largely holds good in England, where members of a corporation are elected for two or three years, and so many retire annually; and as a general rule I think this is the condition of affairs on the Continent; but it was as to *this* Continent that I understood the paper applied.

MR. TABER—I would like to ask whether there are any gas

undertakings in the West and South which are being sought for by the municipal authorities. So far as New England is concerned I might almost say there are none. I know of but two that have been taken in, or taken over perhaps, by municipal authorities in Massachusetts during the past year, and that was done solely and entirely in order to get possession of the electric light plant. The gas plants, as the parties themselves told me, were secondary considerations. At one of the hearings before a committee of the legislature in Boston last winter I noticed that almost every thought expressed in the arguments related entirely to the electric light interests; and it seemed that the desire of the municipalities was for electric light, not for gas. I am not fully informed as to the West and South; but I know that it is the case in New England. So that as a practical question the municipal ownership of gas works has not come up yet before the New England authorities.

MR. C. J. R. HUMPHREYS—One thought occurs to me with regard to the matter of interest of which Mr. Littlehales speaks. It is true that corporations can to-day borrow money very cheaply; but I have frequently heard the statement made by the capitalists that the reason they are willing to pay a high price for a low interest bearing bond of a municipality is because a municipality is not engaged in any trade; but that if a municipality were to go into any trade eventually, then they would not pay any more for a municipal bond than they would for the stock or bonds of a corporation. I am inclined to think that you will find that would work out that way in practice. If several of the smaller cities were to invest very largely in lighting plants I think it would be found they could no longer borrow money at the same rate of interest they can now; and then the so-called advantage would very greatly disappear.

MR. KEPPELMAN—Mr. President, I have been a member of the city government of Reading, Pa., for the last fifteen years—for the first five years as City Clerk, and for the last ten years as a member of the Board of Aldermen; and I still have four years ahead of me to serve. While it is not for me to say what sort of a legislator I make, I am not too modest to say that in my humble opinion no city ought to indulge in any commercial

venture. I have had experience enough in municipal matters to show me that it is not so much a question of four per cent. bonds, or of dividends, as it is of management. I am quite satisfied that no gas consumer would be served a quarter as well by a municipal corporation as it is served by a private company. At the last session of the Pennsylvania Legislature a bill was presented looking to the creation of a Gas Commission for our State. I will say that I will hail it with a great deal of satisfaction when a commission is created in Pennsylvania; for I believe that a commission will stop this agitation of the question of municipal control better than anything else that we can do. And, without knowing anything at all about it, I will say that I believe that in Massachusetts they do not talk half as much about municipal control as we do in Pennsylvania. I believe that such a commission would stand between municipal control and communism. I believe that is the cure we have got to look for. Notwithstanding the petty annoyances that a commission may bring about, and the little disagreements that may result, I think we had better stand those than stand this public agitation all the time.

MR. COGGSHALL—If the gentleman lived in the State of Massachusetts he would not feel the need of any commission. I want to say in relation to what the President of the Association in his address this morning said as to the class of men who control city affairs in England, that we do not get such a class of men here. This is known to everyone connected with any city in Massachusetts or New York. When we read the exposition now being made before a committee in New York as to municipal matters we are led to inquire, if New York had owned its gas works what would they be paying for gas to-day? Two dollars.

MR. ADDICKS—As I understand the theory there are two important points which consumers urge when they favor municipal ownership. One point is the cost of gas. They wish to reduce the cost. But I think that as a rule consumers realize that they get gas at a less cost under private management to-day than they would under municipal management. But there is another reason to be urged against municipal control. That is the con-

stant digging up of streets, and the matter of repairing the pavements after they are dug up. I do not refer now to the competition; I do not wish to touch upon that subject; but I refer to the ordinary work of gas companies. I leave it to every manager of gas works to say whether the services in streets are placed back in the most perfect manner. Do not let the city set an example for the gas company in that respect, but let the gas company set an example for the city, and then insist that the water company shall keep up to that example.

MR. FODELL—In the matter of repairing the streets I will say that the city in which we have our works is amply protected by provisions in the grant or charter which obliges the company to repair the streets under the direction of the city. That is a point stronger than any stated in Mr. Clark's paper. But there is another aspect of that question. Several grounds have been mentioned in favor of the city owning the gas works, and it has been said that they can protect the people better. Now, are there not other things that the people use in respect to which they require protection, as well as light? How about their bread? As Mr. Clark says, we are going into communism. Certainly bread is more important than light. Why not then in every city have a large bakery, and so carry out that argument? Where would it lead to? To communism.

MR. JENKINS—I find, Mr. President, that the general public go into details very loosely in considering the question of what it costs to run gas works. We in Columbus, Georgia, are stirred up over the question of the municipal ownership of water works; and I have taken special pains to be on the opposite side to the city. I have always taken special pains to impress upon my friends in Columbus what would be the profit if the city owned and managed the gas works, and I have sought to ascertain what are the detailed expenses; and no one of them that I have yet seen has been able to give me any detailed statement of what the expenses would be. And I think that the general public as a rule go into these things just in that sort of shape. They will do anything to have the city take hold of such matters. They read the statement, or the claim, that the water works company has made an enormous profit in the last two

years, and they at once ask themselves why the city cannot do the same thing. And yet the Columbus Water Works has only paid one dividend in ten years.

THE PRESIDENT—Mr. Clark will close the discussion on his paper.

MR. CLARK—There seems nothing in the remarks of the gentlemen to call for a special response from me, but I desire to cite, on the effect of municipal ownership, and the reliability of some self-constituted authorities on the subject, a single instance. Prof. Bemis of the Chicago University went down to Ohio and investigated the Bellefontaine gas plant. He wrote a letter upon the subject, and among other things said he found that with an ordinary photometer at the works the gas registered about twenty-two candle power. I followed Prof. Bemis to the Bellefontaine Gas Works, and took with me a photometer of the most improved pattern. I tested the candle power a short time after Prof. Bemis had made his test. He made his test at a hotel where he said the gas was consumed; and I made my test at what I assume was the same hotel, or at one of the hotels in the town. My test showed that the gas was under five candle power. I had every appliance for insuring accuracy. A gentleman now in this room, Mr. Brown of the *Progressive Age*, was with me. He is not a photometrist, but saw what I did, and took part in it. But I did not like to trust that statement to anybody; and so I wired to Virginia, to one of my assistants, Mr. Page, a member of this Association, to come and make a test. I had in the meantime been down to the gas works, and told them what I was there for; that I did not take any stock in municipal control; and that I was there to find out what I could about it. By the time Mr. Page reached Bellefontaine, about two days later, the candle power was something over eight. I met him at the depot, told him nothing about what the candle power was, but took him to my room in the hotel. He made a test of the gas there with a hundred inch bar photometer, and it was within a few tenths of the candle power of the last test. With this ordinary photometer used by Prof. Bemis I found that when the candle power was between eight and ten I could make the flame rise to the top of the photo-

meter—the photometer being a colored glass chimney, with colored figures upon it, superimposed upon a brass base, and having an alleged governor underneath. It was not as reliable as the ancient method of weighing a hog—by balancing the hog against a pile of stone, and then guessing at the weight of the stone. I speak of this not so much to show what the Bellefontaine gas works are doing, as to warn you against accepting the statements of men who are talking about matters not directly concerning their own line of business.

On motion of Mr. Evans, seconded by Mr. Boardman, the thanks of the Association were voted to Mr. Clark for his paper.

The Association voted to accept the invitation of Mr. Prince, a photographer, to stand for a group photograph on the steps of the Treasury Building to-morrow morning at half past nine o'clock.

THE SECRETARY—There is one paper that was requested to be read before the Association, and has been printed in the Quarterly—a paper on “Taxation,” by Mr. Allen R. Foote. Mr. Foote is in poor health at the present time, and has requested that he be excused from reading the paper. In view of the fact that it has been printed in the Quarterly, and every member has no doubt received a copy of it, I move that Mr. Foote be excused from reading the paper.

MR. ADDICKS—In addition to that I would move a vote of thanks to Mr. Foote for his paper, and that the Secretary be instructed to communicate the thanks of the Association to him.

MR. GRAEFF—I second the motion. (Carried.)

The Association then adjourned to Thursday, October 19th, 1894, at ten A. M.

SECOND DAY—OCTOBER 17TH—MORNING SESSION.

The Association met at 10 o'clock A. M.

THE PRESIDENT—The first business this morning will be the reading of the paper by Mr. Frederick Egner, entitled "Observations on Sundry Methods of Making Water Gas from Bituminous Coal."

Mr. Egner then read his paper and supplement.

(See Vol. XI., No. 1, Page 58, and No. 2, Page 169, and please note the following corrections: In No. 2, Page 170, in the table, Reference No. 6, second column from right, should be 80,000, instead of 180,000. Reference No. 9, third column from right, should be 26.0, instead of 25.0. On Page 171, fifth line from top, "No. 10," should be "No. 8.")

THE PRESIDENT—This interesting paper is now before you for discussion, and we shall be glad to have you freely take part in that discussion. There are some water gas gentlemen here who will no doubt do so.

MR. EGNER—It is necessary to make a further explanation with regard to this paper. I met some gentlemen at the headquarters who took exception to one of the processes touched upon. I wish to do injustice to no one, and for that reason I say that that particular process was, as I stated, and as you have all heard from the paper, then in its experimental stage. I have seen a pamphlet and drawings of it since which are very different from the original process, and it may now produce the results which are claimed for it. The matter I have given was based on information given me, and what I saw stated in the papers as absolutely so. I might go on further with the explanation and call up a matter that I saw recently published in some of our gas journals, in *Light, Heat and Power*, for instance; but I am afraid it would take up too much of the time of the convention for me to do so. I want to say, however, that the figures I have given are so, and I can prove them, partly over the signature of the general manager of the company. The process, by the way, has been largely improved. I am not at-

tacking it as it is now; I am only saying what it was at that time. I have not seen it since, but I have seen the drawings; and a statement was made then over the signature of the general manager of the company; and I got my information partly from conversation with the superintendent of the works. He is now in the hall, and I do not think that he will gainsay what I have said. I want you all to bear in mind that the process is now entirely different. The same inventor has associated with him another gentleman, and they have apparently gotten up a very good apparatus. I have been told that my figures as to coal were not right. After the paper was printed in the Proceedings my attention was called to the fact (by Mr. Blodget and by Mr. Loomis) that the coal given was not correct; that the coal as I stated it was per thousand of fuel gas; and that per thousand of commercial gas it would have been much less.

MR. GARTLEY—There is one point about Mr. Egner's paper that I would like a little information on. Of course I know that Mr. Egner is too experienced to be caught by a general statement. I would like to ask him whether in the process he describes as being the one in use near New York, and which uses the Sterling coal, he knows for himself that the data given in connection with that is correct; or whether he has accepted the statement of some one connected with the company.

MR. EGNER—I would say that the figures were given to me by the superintendent of the works. I frequently visited the works. I believe the figures given to me by the superintendent to be correct because in a process very similar to it our results were even a little better than he claims.

MR. GARTLEY—He speaks of using Sterling coal, and says that about five per cent. of that coal was taken away when cleaning. I want to ask him whether that five per cent. is the only refuse that comes from the apparatus.

MR. EGNER—No; for I have been informed that some of the tar and oils are used for fuel also.

MR. GARTLEY—I refer simply to the coal.

MR. EGNER—About five per cent. of the coal that becomes

cooked in the generator was used under the furnaces. That was the information I was given.

MR. FORSTALL—Mr. Egner speaks of twelve pounds of fuel being used in the boilers to supply the steam. I would like to ask him if that steam is simply the steam supplied to the generators, or steam that is used all over the works for running the engines, pumping, heating, etc.

MR. EGNER—In my experience it was all the steam used.

MR. ADDICKS—I would like to add to Mr. Egner's statement the results obtained from the Flannery apparatus in works with which I am familiar. The coal in the generator, making 930,000,000 feet per year, was 34.55; the oil (which is naphtha) is 4.73; candle power of the gas, 25.68. That coal includes six per cent. added for shortage. The measurement of the oil is the measurement at the shipping point, and not as received by the company. In order to make it plain I will have to add the coal for the boilers, which amounted to 12.61. We did not do very well, according to Mr. Egner's statement, so far as the boilers are concerned. I will explain, however, that there is not a pound of fresh coal used in the boilers outside of the coal slack which comes in the hard coal. The remainder consists of screenings which come from the generator. In other words, the total fuel coal for the entire year amounts to 47.16. That was made up of the shavings that came from under the purifying boxes, adding in 0.47 of a pound. In detail, the coke under the boiler was the coke used for screening out the tar, and amounted to 0.08 of a pound; the coal screenings in the boiler amounted to 0.97; the cinders amounted to 11.09; shavings, 0.47; total fuel oil, 12.61.

MR. EGNER—I think that Mr. Addicks' results with the Flannery apparatus are exceedingly good. The results I gave were from averages of four months' work with from six to eight generators; and while I know that the work could have been improved, I must say that Mr. Addicks' figures are very good indeed. As to the coal used for steam, as I remarked in the body of the paper, that depends largely upon the boiler. If you have a plain cylindrical boiler surrounded with brick it will

make all the difference in the world, even the firing of the boiler itself.

MR. ADDICKS—I think that the amount of coal under the boiler depends so much upon the location that it is hard to bring it into any figures. Some works are very large and are exposed to severe snow storms, and as it has been remarked here the steam is required to take care of the plant a larger number of days in winter than ordinarily.

MR. GIBBONS—Referring to Mr. Egner's statements with regard to the use of one apparatus I would like to say for the information of the gentlemen here that I was present with Mr. Egner at the time, and gave him the statements with reference to the working of the apparatus. And lest members of the Association should go home with a false impression, such as his statement would make, concerning the apparatus in question, unless some further remarks were made, I will ask permission to make some friendly criticisms as to the condition of the machine as I found it on February 1st, 1893, when I arrived at the plant. First, with regard to measuring the gas. The gas was measured by a scale on one of the columns of the relief holder, and not by the meter. Shortly after arriving I had the meter repaired and put in operation; and when I presented my quarterly report to the directors of the company on April 1st, 1893, I estimated that 67 per cent. of all the gas made up to that date was unaccounted for. That was to the date of the starting of the meter. From the date I started the meter, on the 12th of March, to the 1st of April, I estimated that nine per cent. of the gas made from that date was unaccounted for. However, on the 1st of July, when I had the meter in operation, I was led to believe that the first part of the statement, as to the 67 per cent., was too high, while the latter part of the statement was too low, as the loss by shrinkage in condensation between the station meter and the consumer's meter was 14 per cent. The second criticism that I wish to make on the machine is that the outlet from the machine—a twelve inch outlet—was connected to the six inch inlet of the relief holder without a valve intervening. I therefore found when I arrived at the works that I could not make gas and exhaust it from the relief

holder at the same time. In order to repair this defect I was connecting a twelve inch wrought iron pipe when Mr. Egner arrived. A second defect that I found in the machine and tried to repair, and partially did so, was that the overflow pipe from the hydraulic main was only two inches in diameter; and that pipe was also intended to carry the waste water and residual from three scrubbers, besides the hydraulic main, and to carry it almost on a level for about sixty feet, from the outside of the building to the relief holder. This was caused in part by the fact that there was a permanent injunction restraining the company from emptying their water into the creek—the only place they had to empty it—and so they were obliged to carry it a distance in order to have it soak away in the ground. When I arrived at the works they were making gas, according to the weekly statement, for seventeen cents and a slight fraction for the material. The first week I made gas, according to the *holder* registration, for sixteen cents and a fraction for the material. However, after getting the machine into proper operation I never succeeded in making gas for less than twenty-two cents; and I did that with soft coal, with screened nut coke, using Pennsylvania crude oil. During the ten months I was at the works I only used one car of anthracite coal. I was using that when Mr. Egner visited the plant. I obtained with that anthracite coal, as I imagined, the best and the worst results obtained during my stay at the works, viz.: twenty-one cents and a fraction, and twenty-eight cents and a fraction, per thousand, for material. All these defects which have been mentioned in the machinery have now been remedied by the inventors, and the machine now looks to me quite practical; and I assure the Association that they can make a good candle gas with bituminous slack with the process I refer to.

MR. HAUKE—It appears that the figures given by Mr. Egner are somewhat misleading; and as he has just stated that the results recently obtained are entirely different, it seems to me that further discussion is unnecessary so far as that apparatus is concerned. There is one point, however, in the paper that I wish to call attention to. While Mr. Egner says that the real facts as they now appear are different, the facts which he states are

not the new facts as they now appear; and had he given the facts as they now appear, so far as that process is concerned, they would have proved satisfactory. But the explanation he has given covers that point.

MR. LOOMIS—As I understand Mr. Egner's paper it was a comparison of a soft coal apparatus with an anthracite coal apparatus. He gave his figures with regard to the work at Williamsburg. At that time part of the gas made was coal gas, and part was water gas from the generators that we erected there. Since that time, and during the summer, the entire works have been running on water gas altogether. The last month's statement in regard to the amount of coal that it takes per thousand feet of commercial gas is thirty-one pounds in the generator, and nine pounds including everything else—the steam used for hoisting coal, pumping water, and for everything that is done about the works; making a gross of forty pounds. The gas made at Williamsburg is carbureted in the retorts. The oil is carbureted in the retorts, and the gas is made in the generator; 4.81 of oil includes all the drip oil and everything that is used outside of the producer gas made in the generator in carbureting the gas. That includes the entire amount used.

MR. BOWEN—Mr. President, in the papers presented by Mr. Egner we must take issue with his manner of comparing results, or rather his method of obtaining results, to be used in comparison. In the tables given in regard to the apparatus designated No. 7, it would be interesting to know just how the results therein mentioned were obtained by Mr. Egner. He states in "Remarks" that the process was "Experimentally," consequently one would hardly expect him to place it in comparison with machines on which he gives us "year's average."

In the tables given when soft coal apparatus was being considered it would seem more proper to have given only those using soft coal, and on the question of hard or soft coal, then a different comparison could easily have been reached.

As will be seen, coke is used in No. 7 statement not for generator use, but for fixing purposes, and this is one feature that in Mr. Egner's observations he has overlooked, and is a very

important feature. The proportion of slack to coke used varies in different size machines, from 5 to 1, to 3 to 1.

The manner of producing gas by the Rose-Hastings process is essentially different from the others in the fact that the gas is differently treated during progress from generator to seal. While blasting, the products of the gas coal are utilized in the machine, thus bringing the loss of heat units to a minimum, and the heat is stored in checker brick, which are placed in every available space. Then the carbureting is done in hot fire brick and the gas immediately passed through the red hot coke, there undergoing a change intended to add to the stability of the gas and the candle power by reason of the action of the red hot coke on the oil vapors contained in the gas.

The machine here quoted has never had an opportunity of running to its full capacity, and the results we can give are but for intermittent work; but we are sure the results given could be very much reduced by steady and constant work. We give, however, reports from three different machines whose results are such as to show what has been done.

	Coal. lbs.	Coke. lbs.	Oil. galls.	Candle power.
No. 1. West Chester, Pa	42	21	3 7-10	24.
No. 2. Louisville, Ky.	35	10	2 1-2	20.
No. 3. Elkhart, Ind	36	14	2 7-8	22.6

No. 1. Report for three months ending Nov. 1, 1893.

No. 2. Reports of Mr. McDonald, President Kentucky Heating Co.

No. 3. Report of Superintendent, Geo. T. Murdock, Aug. 16, 1894.

Capacity per man—100,000 cubic feet.

The records of these machines can easily be verified, and we give these statements without disparaging, in any manner, the merits of any other process.

One more reason why soft coal should be used for water gas is the reason which was so well put by Mr. McDonald, that dollar for dollar more heat units could be had from soft coal than any other fuel, and such being the case, it is the most valuable for gas making for whatever purpose you may require. Gas to

be good for fuel must be high in heat units, and so too for illuminating gas, particularly as gas is being so largely used for incandescent gas lighting, and for the purpose of power and cooking and heating. Gas of this character was made last winter for fuel purposes, and supplied to the city of Louisville, Ky., with the thermometer at zero and all the natural gas off, and this was kept up for some days, and no complaints whatever were heard, indeed, the people did not know that they were burning artificial gas.

It shows then that the future of soft coal water gas is great, that there is no reason why gas cannot be made in large quantities at such prices as will make it possible to furnish all the gas required for heating a city and to supply a smokeless fuel to her manufactories, and a means of power that should be largely used in many branches of industry. Those sections of the country which now enjoy the natural gas luxury can have a means of keeping up the supply by soft coal water gas, made in very large quantities and sold for light and heat, and at a figure that will surprise many of the men who sold gas for light only a few years ago. We hope the end is not yet reached, but, as the demand increases that the gas men of the day will be ready to solve the question and give to the whole people a blessing to every home, a gaseous fuel, cheap and good, high in heat units or candle power, and this will, I am sure, be a soft coal water gas.

THE PRESIDENT—Unless some other gentleman wishes to discuss the matter, I think we shall have to consider this discussion closed; and Mr. Egner can have opportunity to say a few words in reply.

MR. SHELTON—I think the point is insufficiently brought out that the amount of gas made will vary from 75,000 to 120,000 is not so much dependent upon the form of the apparatus as upon its size. Mr. Egner has given us the working of the Flannery and other settings; and we are expected to take these concrete figures and accept them as true; but we should bear in mind that the rate made is much more dependent upon the size of the apparatus (no matter what the make or process may be) than upon the ground that Mr. Egner puts it in his paper.

MR. EGNER—I have purposely left some things unsaid in this paper in order to bring others out. I did not mean to bring out so much of an advertisement, but it has brought out the facts as you have heard. I want to make one correction in this table. I stated that with No. 6, 180,000 cubic feet of gas was made per man. That is a misprint. It should be 80,000, and not 180,000. In other respects I fully agree with Mr. Shelton.

On motion of Mr. Prichard, seconded by Mr. Hauk, the thanks of the Association were voted to Mr. Egner for his paper.

THE PRESIDENT—The next paper to be read is the one by Mr. Evans on

PETROLEUM: ITS PRODUCTS AND THEIR RELATION TO THE GAS INDUSTRY.

Years ago petroleum was first discovered in the United States by the Indians, who observed a thin, oily film floating on the rivers of Pennsylvania. Their means of collecting it was by spreading their blankets on the surface of the water until they become saturated, then squeezing the oil so collected from the blankets into vessels. This oil, which was believed to possess great medicinal properties, was used by the Indians for almost every ailment, and was bottled and sold quite freely to the white population, under the name of "Indian Oil," as a remedy for sprains, bruises, rheumatism, and, in fact, almost every disease common to mankind.

Petroleum is found to exist in the United States, saturating porous strata of sand-rock. The first well began to flow at Titusville, Pa., in 1859. The regularity of these oil sands, as regards their thickness and the intervening distance between them, is quite remarkable. In the Oil Creek district the first oil sand is found to be about 40 feet thick, with an interval of 105 feet between it and the second sand, which is 25 feet thick; a distance of 110 feet occurs between the second and third, the latter being about 38 feet thick. In a great many places the sand rock disappears, its place being taken by shales at the

same geological horizon. Petroleum is generally considered to have resulted from the slow decomposition of vegetable or animal matter, either in the rocks in which it is found, or in underlying strata. Berthelot, however, in 1866, propounded the theory that petroleum was formed by the action of carbonic acid and steam on the alkali metals.

In 1867, Mendelejeff read an essay before a chemical society of St. Petersburg, and gave in detail his reason for believing petroleum to be produced by the action of water upon iron and carbon at a high temperature and under a great pressure. From recent researches I am led to believe that the varieties of petroleum found in Ohio, Pennsylvania, and New York are distinctly of vegetable origin, while the California and Kentucky oils are without doubt of animal origin. De Kramer gives .78 and .97 as the extreme limits of variations in specific gravity of liquid petroleum. In this form it consists almost entirely of carbon and hydrogen; C, 84 per cent.; H, 14 per cent., and O, 2 per cent., being a fair average analysis. In 1863, Pelouze and Cahorus succeeded in separating twelve distinct hydrocarbons from petroleum, which were found to be homologues of marsh gas ($C H_4$). The depth of petroleum wells has gradually increased in the United States, from 430 feet, in 1861, to 2500 feet, or more, at the present time; the famous Gordon well in Washington County, Pa., being 2400 feet deep. The producing wells in the United States number 30,000 or more, but the great majority furnish only a few barrels of oil per day, although some are stated to have yielded as high as 280,000 gallons per 24 hours for a short time. The ordinary life of a well that is worked is about four years. The growth of the oil business in this country is phenomenal. In 1860 something less than 100,000 barrels was produced, while in 1893 it reached the enormous figures of over 3,400,000,000 gallons. Something like 900,000,000 gallons of this was exported to other countries. It is quite evident that, with this wonderful production, increasing year by year and being gradually reduced in price by competition with foreign products, that the water gas companies need have no uneasiness as to the future, and coal gas companies might even put aside that old bugbear "that the use of and demand for such large quantities of oil would raise the price of oil to such

a point that it would be out of reach for the economical production of gas."

It is well known to you all that distillation is the means used to separate the different gravities of oil from crude petroleum, and that by the application of different degrees of heat the various products are produced. The first product is rhigolene and is exceedingly volatile and perfectly colorless—it has a density of 90° B.; then follows gasoline, 88° to 86° B.; boulevard gas fluid, for street naphtha lamps; benzoline, 74° B., for gasoline stoves; benzine, 62° B., and so on down to the lubricating oils and paraffine, finally resulting in a deposit of solid coke or carbon. In the application of the products to the gas industry, those which interest us most are between the gravities of 38° and 70° Baume, as shown below, in Table No. 1:

TABLE No. 1.

Density, Baume.	Specific Gravity.	Weight per Gal., 231 cu. in.
38 deg.	.839	7.00 lbs.
40 "	.830	6.92 "
42 "	.820	6.84 "
44 "	.811	6.77 "
46 "	.802	6.69 "
48 "	.794	6.62 "
50 "	.785	6.54 "
52 "	.777	6.47 "
54 "	.768	6.39 "
56 "	.760	6.32 "
58 "	.753	6.24 "
60 "	.745	6.17 "
62 "	.730	6.09 "
64 "	.721	6.02 "
66 "	.712	5.94 "
68 "	.708	5.87 "
70 "	.694	5.79 "

The most important item in the cost of carbureted water gas is without doubt the oil. The quantity used per 1000 cubic feet of gas made at the different works throughout the country is even more varied than the different processes in use, while the various gravities of oil used have their staunchest advocates of their respective grades. There does not seem to be that unity

of opinion so desirable among gas engineers on a subject of so much importance to the gas industry. My inquiries among numerous gas companies, as to the quantity of oil used to carburet 1000 cubic feet of gas, have developed a most deplorable condition of affairs at some works; while at others the claims made are, to my mind, too good to be true. The two extremes which have been brought to my notice are represented by the figures of 2 7-8 gallons, 44° B. gravity crude oil per 1000 cubic feet of 22.50 candle power gas, made by one fortunate individual, and 9 gallons per 1000 cubic feet of 24 candle power gas, made by a poor unfortunate whose troubles are too serious to deserve censure. The problem before us is what gravity of oil shall we use and how shall it be treated to obtain the best results. The manufacturers and promoters of the too-numerous-to-mention gas apparatus on the market to-day leave the would-be-purchaser in a quandary as to which is the one to be desired, each claiming superior merit in construction and each claiming to use a less quantity of oil for a given quality and quantity of gas than all others. I do not propose to discuss the merits of any particular gas apparatus in this paper, but wish to confine myself mainly to results.

It will be noticed, by reference to the above table of specific gravity and weights of various degrees of petroleum, that 38° B. is 17.4 per cent. heavier than 70°, and it would be fair to presume that the former would, if properly handled, give results in gas making equal to the difference in weight. Such, however, is not the case in practice, owing chiefly to our methods of using it, and, in a degree, to the difficulty of preventing the formation of tar. This latter element is the bane of those who use crude oil, but it can be largely overcome by carrying extremely high heats in your superheater, and avoiding, as much as possible, all back pressures when a run is on. By experiments I have satisfied myself that crude oil, to be used successfully, should be atomized to the highest practical degree when injected into the superheater. This should not be done by steam, as is practiced by some, unless perfectly dry and at a very high pressure, as the excess of water vapor carried over through the generator, together with the usually wet steam used to inject the oil into the superheater, have a tendency to form carbonic acid (C O_2)

in quantities sufficient to very materially increase the quantity of oil necessary for the desired candle power. It has been suggested by a prominent gas engineer that hydrogen gas (so-called) under pressure could be used for this purpose with great beneficial effects.

A short time ago I made several experiments to ascertain the exact quantity, specific gravity and candle power of gas that could be obtained from a gallon (231 cubic inches) of oil of different gravities. The apparatus I used was so constructed as to collect all condensation readily, and in fact to recover any products that might remain after the gasifying was completed. All condensation that appeared was drawn off and passed through the apparatus; this was repeated until no further condensation appeared. How much of the total weight was converted into gas will appear in the figures below, marked Table No. 2:

TABLE No. 2.

	Degrees, B.	Specific Gravity.	Weight per Gal. 231 cubic inches.	Cubic feet gas made per gal. oil.	Specific gravity gas made 62° F. (Air 1000).	Weight gas made.	Loss by weight.	Observed corrected C. P., burning 2 feet per hour, using 2 feet E. H. Tip.	C. P. value from its effect as an enricher.	
			lbs.			lbs.	lbs. pr.ct.			
Lima (O.) crude oil.....	38	.839	7.00	70.	1315	6.53	.46	6.66	56	83.5
Northern Ohio crude oil...	44	.811	6.77	73.1	1272	6.52	.24	5.06	54	82.
Ohio gas naphtha.....	54	.768	6.39	77.	1121	6.13	.24	3.75	51	79.5
“ “ “.....	60	.745	6.17	81.2	1040	6.03	.13	2.16	47	78.
“ “ “.....	70	.694	5.79	83.3	900	5.67	.11	2.	45	72.

With such figures before me it is difficult to reconcile some statements which have reached me regarding results obtained by the addition of 4.06 gallons of benzine, 70° B., per 1000 cubic feet of gas made, or a 22 1-2 candle power gas from 2.7 gallons crude oil. I am, with several others, anxious to be

enlightened in order that we may do likewise. The commercial gas represented by the former was reported to be composed of 72.95 per cent. of hydrogen and 27.1 per cent. of naphtha gas. If this be true, then the cubic feet obtained per gallon would be 66.75, and the candle power 110.50. I am aware that the observed candle power does not do justice to the enriching value of the heavy oil gas. This is due no doubt to the imperfect means at our command for burning perfectly a gas so heavy with hydrocarbons.

It will be noticed, by reference to Table No. 2, that the enriching value of the oil gas is increased on an average of 56 per cent. by mixing with hydrogen gas. In other words, the hydrogen gas, when mixed with the oil gas, increases the flame temperature of the latter to such an extent that the minute particles of carbon are heated to a brighter incandescence, thereby giving a much higher candle power per given quantity of gas burned. The hydrogen gas used in the mixture referred to, though free from sulphureted hydrogen (H_2S) had about 2 1-2 per cent. of carbonic acid (CO_2) and 1 per cent. of nitrogen (N) in its composition, the presence of CO_2 being due to the use of oxide for purification. If the N and CO_2 had been entirely eliminated, the candle power would have increased at least 3 per cent. Pure hydrogen gas (so called) free from CO_2 and N , high heats, preheating and atomizing the oil, and relief from back pressure, are all essential to obtain the best results. On the matter of heats, I wish to dwell briefly. The same heat that will convert the oil immediately into gas will also burn the gas into lampblack, if left in contact with the highly heated brickwork too long. High heats not only increase the cubic feet of gas obtained per gallon of oil, but also increase the candle power. High heats form a different series of hydrocarbons, creating a larger percentage of the benzene series, which are known to add more to the illuminating power of the gas than the other hydrocarbons. This subject is one of deep interest to the gas industry, and especially so to the manufacturers of carbureted water gas.

In presenting this paper to the Association, I am well aware that, in all probability, it will convey but little information, if any, to some of the members, who have already, perhaps, given

the subject even more careful consideration than myself, but if through its medium a single member shall have been benefited, then the object of the writer will have been attained.

THE PRESIDENT—You have listened to an interesting and valuable paper, and we shall be glad to have a discussion upon it.

MR. THOMPSON—I think that the table which Mr. Evans has given us of the comparative production in weight, candle power and volume of mineral oil is one of great value to us, and one which we will long turn to for reference. I would like to ask him, in case a man is carbureting coal gas by the retort process, manufacturing gas from oil by the retort process, what he would consider a fair value to put upon the quantity of gas made from oil so as to obtain his noted yield per pound of coal. Do I make my question clear?

MR. EVANS—I think so. The loss by weight of oil noticed in the table showed a very small amount, in pounds; but when oil is passed through the retort in the form of which you speak I think you ought to be able to obtain the same results I did here, provided you run the exhauster under a slight vacuum to take your oil away, and do not leave it in contact with the service too long; and get your heat as high as practicable and not form lamp black.

MR. CLARK—What was the figure you gave per gallon of oil?

MR. EVANS—There were five different grades spoken of.

MR. CLARK—What for the equivalent of crude oil in gravity?

MR. EVANS—The equivalent in pure gas from a gallon of crude oil was 70, candle power $83\frac{1}{2}$.

MR. CLARK—How did that compare with naphtha?

MR. EVANS—It is slightly better than 70 degree naphtha—better in candle power, not in feet. Naphtha gas is higher in feet, being 83.3, and the candle power was lower, being 72.

MR. CLARK—Do I understand that the distillation was made experimentally?

MR. EVANS—Yes.

MR. CLARK—I have not in my own practice in distilling oil on a commercial scale been able to obtain more than 70 to 75 feet from day to day, of about 60 candle power gas, and distilling in the retorts. I think the figures Mr. Evans quotes are better than anything I have had any knowledge of, although I remember a claim of 80 feet of 100 candle gas was made years ago, and I think before this Association. I would like to inquire of Mr. Evans at what heat (I did not hear the whole paper and am under the necessity of asking a few questions which may seem impertinent) distillation took place to obtain from naphtha 70 feet of over 80 candle gas?

MR. EVANS—Mr. Clark misunderstood me. I stated that we obtained 83 cubic feet of gas that had the equivalent of 72 candle power when mixed with hydrogen gas. When tested on the photometer bar no such results were shown as I stated here, evidently an imperfect method of testing light of such high quality.

MR. PEARSON, Jr.—The commercial value of naphtha and crude petroleum have not been considered, have they? In using crude petroleum, or at least gas oil, in our company, where we can utilize petroleum tar under the boilers altogether, they do not use any fuel other than petroleum tar at present, and that enables us, by using the distillate, to do away with all other boiler fuel. At present we are making gas with a little less than 30 pounds of coal or coke, that being the total boiler fuel, and the coal used under the generator. The tar is very valuable with us now.

MR. COLLINS—I would like to inquire of Mr. Pearson how much tar is made per thousand feet of water gas?

MR. PEARSON, Jr.—We have more than sufficient to run two boilers for making water gas, and two boilers for exhausting gas for the relief holder, and for heating different parts of the works. I might state that we use about $2\frac{1}{2}$ barrels of tar as equal to about a ton of coal. We are now using sixteen barrels of tar per day to run the water gas plant.

THE PRESIDENT—We make about ten per cent. of tar.

MR. THOMPSON—The question with regard to the production of tar and its effect upon the comparative value of naphtha and petroleum is answered by Mr. Evans' paper, in which he states as I understand it, that he repeated the distillation until the quantity of the residuum was at the minimum, and that quantity of residuum was also stated in his table. If any gentleman here has manufactured Pintsch gas it might be valuable to compare his results with those which are stated as experimental results in Mr. Evans' paper.

MR. EGNER—I have had some experience with the Pintsch gas, and I will give you a few figures on that. Pennsylvania crude oil gave 70.49 feet of gas to the gallon, candle power 45.5; Pennsylvania naphtha 50.90 (that was a bad sample of naphtha, and we can get better results), candle power 46; Lima crude oil gave 63.16 feet per gallon, candle power 56.2; Lima naphtha, 61 gravity, gave 72.15 cubic feet per gallon, candle power 45.8. Those are results obtained at the Pintsch works. I do not know whether they are the best that can be obtained, but that is what they did obtain.

MR. CLARK—Were the candle powers tested immediately before or after compression?

MR. EGNER—It is the candle power of uncompressed gas, with flat flame burner; but the burner was a small one, for oil gas, of 2.4 cubic feet per hour. The tests were made by Mr. B. E. Chollar.

MR. SERRILL—I would like to ask Mr. Evans if the hydrogen used was pure hydrogen, or blue water gas?

MR. EVANS—It was water gas,—hydrogen so called.

MR. GARTLEY—Mr. Evans has expressed surprise that a candle power of 24 is obtained in some works with $2\frac{1}{2}$ gallons of oil. An analysis of the gas would show that the illuminants in the gas weighed more than the oil before it was admitted to the machine. But it occurred to me that possibly Mr. Evans might have asked that question of some company that have other sources of illuminants, such for instance as an apparatus which is using soft coal, for I understand that there are some illumi-

nants obtained by distillation of the soft coal that goes on in the machine. I would like to ask him whether he knows anything about that.

MR. EVANS—I would say that the figures referred to came from just such an apparatus. I investigated the apparatus. As I said in my paper I do not care to discuss the value of one apparatus over another; but if I had thought that it was not possible to make those results I would not have stated them in my paper.

On motion of Mr. Gartley the thanks of the Association were voted to Mr. Evans for his paper.

THE PRESIDENT—I find that Mr. J. P. Harbison, who was appointed Chairman of the Committee on the President's Address, cannot act, and in relieving him I will name in his place Capt. Wm. Henry White.

The Association took a recess until 2 P. M.

SECOND DAY, AFTERNOON SESSION—THURSDAY, OCT. 18.

The Association re-assembled for business at 2 o'clock, P. M.

THE PRESIDENT—We will now listen to the reading of Mr. Slaney's paper, entitled, "One of the First Meter Makers in the United States."

Mr. Slaney then read his paper, for which see Vol. XI. No. 2, page 130.

THE PRESIDENT—This paper being almost entirely historical is not of a character to require much discussion—unless some gentleman has some exception to make to the dates and order of events which are given.

MR. NEAL—I move the thanks of the Association be given to Mr. Slaney for his paper. (Carried.)

THE PRESIDENT—The next paper on the list is "Some Experiences with the Welsbach Incandescent Gas Lamp," by Mr. W. S. Rathell. Is it your wish that this paper be read?

MR. LITTLEHALES—I move that it be read by title as it is published in the Proceedings. (Carried.)

MR. GRAEFF—I would like to ask for information whether all the papers are to be taken up in their order and finished before any other business is begun?

THE PRESIDENT—All the papers will be finished before any other business is begun.

MR. GRAEFF—I would like to know at what time the subject of Federation is coming up for discussion. I would not like to have that matter postponed until there will be only a corporal's guard in the hall. It is I think of greater consequence than many of our papers, and I would like to feel assured that it will come up for consideration before the hall may be emptied.

THE PRESIDENT—The papers are first in order. I think we shall hurry through with them, and many of them will be read by title only. If we find that the time will be too short to consider other matters of importance it will then be in order for you to move that that matter be taken up.

MR. GRAEFF—Then if it is in order I move that the matter of Federation be taken up now.

MR. LITTLEHALES—I second that motion.

MR. CLARK—Will it not be well to wait awhile, in the hope that more members may come into the hall, before we take up this important matter?

THE PRESIDENT—I confess I would like to see a larger attendance.

MR. CLARK—It is quite probable that more will come in later.

The President put the question on the motion of Mr. Graeff and it was lost.

THE PRESIDENT—We will discuss Mr. Rathell's paper on the Welsbach Incandescent Lamp. You will bear in mind that the author of this paper is not present. Is there any discussion to be had of this paper? No one seems inclined to discuss it and we will pass to the next paper on the list which is the one en-

titled "Light Wasted in Bad Flames," by Mr. N. W. Gifford. Do you wish this paper read ?

MR. NEAL—I move that it be read.

MR. AFRICA—I second the motion. (Lost.)

Mr. Gifford's paper, (See Vol. XI, No. 2, page 146) was then opened for discussion.

MR. ADDICKS—I do not wish to take up the time of the Association by discussing this paper at the present time, but would like to have the privilege of discussing it later on in the Quarterly. It is a question extremely important to all the members, and especially to those who take care of their consumers and see that they are perfectly satisfied with their light. It teaches one of the most important questions as to the relations of a gas company to its consumers ; that consumers should be perfectly satisfied that they get all the light they pay for.

THE PRESIDENT—It will be open to any member to send any written discussion upon this, or any of the papers presented, to the Secretary, who will have very great pleasure in publishing it in the Quarterly. Then I understand that there is to be no discussion of this paper now. The next paper is that of Mr. Harper on the "Applications of Chemical Technology to Gas Manufacture." Is it your will that this paper be read ?

MR. THOMPSON—I move that the paper be read.

MR. McDONALD—I second the motion.

MR. CLARK—Mr. Harper's paper is a very valuable contribution to the literature of gas engineering, but it is not a paper that will call for discussion to any considerable extent. I am thoroughly familiar with the paper, having read it carefully when published in the Quarterly, and was very much interested in it ; but as it is a paper rather for reference than for discussion I do not think it worth while to read it now. I think that Mr. Harper will agree in that.

MR. HARPER—I heartily concur in Mr. Clark's suggestion.

Mr. Thompson's motion was lost.

(For Mr. Harper's paper see Vol. XI, No. 2, page 149.)

MR. ADDICKS—I move a hearty vote of thanks to the gentlemen who wrote these papers.

THE PRESIDENT—The paper of Mr. Harper is open for discussion of course. Do you wish to discuss it? Mr. Addicks has moved a vote of thanks to the writers of these papers which we have passed without reading in full—Mr. Rathell, Mr. Gifford and Mr. Harper.

MR. BENNETT—I second the motion. (Carried).

THE PRESIDENT—The next paper is entitled “The Use of Gas for Other Purposes than lighting,” by Mr. Burdett Loomis.

THE SECRETARY—Mr. Loomis informed me a short time ago that he had been called away and was obliged to go home; and he requested that his paper might be simply read by title and that those who desired to present discussion would write the same and let it appear in the Quarterly later.

THE PRESIDENT—With that explanation do you wish the paper read? Will you discuss it? Then we will pass to the next. We have a number of papers, but are getting through with them very rapidly—thanks to the Quarterly. The next in order is “Patching Gas Holders While In Use,” by J. H. Findlay.

MR. CLARK—I move that paper be read.

MR. GRAEFF—I second the motion. (Carried).

Mr. Findlay then read his paper, for which see Vol. XI, No. 2, page 194.

THE PRESIDENT—This paper is now open for discussion. Does any gentleman desire to say anything upon the subject? Has anyone had a similar experience?

MR. GIFFORD—I had an experience similar to that, but a little different. Some painters were working upon the roof of our holder house and dropped a twelve foot joist upon the top of the holder and allowed it to go about half way through, making a rent thirty inches long and nine inches wide. The holder at the time was about two-thirds full. I succeeded in stopping the outflow of the gas by the time the holder got about half way down. I put on a poultice consisting of canvas with a layer of

Portland cement, covered it with boards, and then piled bricks on. I used the holder in that condition for ten days, until I could ground it and put on something else.

THE PRESIDENT—Has any other gentleman anything to say upon the matter?

MR. LITTLEHALES—It is a most unique experience I must confess to repair a gas holder to the extent he did while still in use, and it shows what energy can do in an emergency. I hope we shall not have to follow him in his experience; but if we encounter the same difficulty it will perhaps enable us to get over it.

MR. FINDLAY—I have here a piece that was put on twenty years ago. That was cut off, and I made a patch exactly like this, (exhibiting specimens) which was put on.

MR. NEAL—I understand that this holder was uncovered. How is it with a holder that has a house over it? How is it with a rent in the lower section, and the wall within three or four feet of the gas holder? Would he dare to repair a holder with gas in it, in such a place?

MR. FINDLAY—I think there would be no trouble. Your sheet is punched, and laid on; and you have a twist drill, and a man can put in a hole very quickly; and you put them on one after another, one at a time.

On motion of Mr. Bennett, seconded by Mr. Littlehailes the thanks of the Association were voted to Messrs. Loomis and Findlay for their papers.

QUESTION BOX.

THE PRESIDENT—The next thing in order is the Question Box. The questions are the topical queries contained in the October number of the Quarterly, with a few more added. The Secretary will read the questions and we shall expect one or more gentlemen to answer them.

(1) *Which is the better pipe for use in services—steel or iron—and why?*

THE SECRETARY—I have been given to understand by people who have used steel services that there was very little choice between steel and iron ; that as far as rusting was concerned there was very little difference. If there are any members present who know anything about the duration of such services we shall be pleased to hear from them. If steel is better than iron we would like to use it.

MR. GRAEFF—I think that Mr. Cowdery has had some experience in that line.

MR. COWDERY—We have used steel pipe exclusively for the last two years. We started to use it because the inside of the pipe was smoother than wrought iron pipe, and there was less scale to interfere with the clear bore of the pipe afterwards. Whether it will last longer, we have not had experience enough to state.

THE PRESIDENT—How do the prices compare ?

MR. COWDERY—I think that steel to-day is cheaper than iron pipe.

MR. LITTLEHALES—I will ask Mr. Cowdery whether the use of steel pipe involves any extra expense in securing the joints ; whether steel does not require more labor to cut the screw.

MR. COWDERY—There is no doubt it does take more labor, and it is harder on the die, but we do not realize any objection from that.

(2) *Which rusts more rapidly in service use—steel or iron ? What kind of yarn is best suited for lead joints—the plain or tarred yarn—and why ?*

THE PRESIDENT—I suppose that, taking in view the fact that steel pipe has been used for so short a time, the first question can hardly be answered. Mr. Cowdery has answered it as far as he could by stating that he has not had sufficient experience. Can Mr. Clark, who has had a large experience in that as well as in other directions, give us any information ?

MR. CLARK—The Company with which I am connected have not used steel long enough to give any information on that

point. We have used steel pipe almost exclusively for three or four years but that is hardly the life of a service. I can see no reason why steel should rust more rapidly than iron. We use a preparation for coating the services which protects from rust. We use steel pipes largely for the reasons given by Mr. Cowdery.

THE PRESIDENT—Has Mr. Thompson of St. Louis had any experience in the use of steel pipe?

MR. THOMPSON—We have used no steel pipe in our services that I am aware of.

THE PRESIDENT—Has any other gentleman any experience? We will pass on to the second part of that question. "What kind of yarn is best suited for lead joints—the plain or tarred yarn—and why?" Can Mr. Addicks answer that question?

MR. ADDICKS—I will say that we are experimenting with tarred yarn in lead joints. The advantage in my point of view is that in driving the yarn back in the bell the joint is less likely to spring back. It certainly has that advantage. The joints have been made both with the plain yarn and the tarred yarn; and the main has been perfectly tight in each case.

(3) *What kind of yarn is best suited for cement joints—the plain or tarred yarn—and why?*

MR. PINKNEY—It seems to me that no gas man will presume to use cement joints on mains, but if he should, then I do not think there is any question but what tarred yarn makes the best joint for the reason that it can be packed so much harder. I have been using nothing else for two years in laying mains, and I find with proper handling the same men with the same tools can make practically a very tight joint with tarred yarn where the same results would not be accomplished with common oakum or common yarn; and with a little cement I have made very tight joints with tarred yarn, for temporary use, which could not be made otherwise.

MR. ADDICKS—I wish to take exception to the first remark—with regard to gas engineers making cement joints. There was a time when I thought there was nothing in the world but lead joints, but after an experience with cement joints, I find that I

have learned something to my advantage. Both are good in their place. I think they are both necessary in any system of distribution. I am also free to say that you can make tight mains with both methods of joints. There are miles and miles of mains under my care which are absolutely tight—and they have not a lead joint in them—and they have been laid for many years.

MR. GEROULD—I would like to ask Mr. Addicks which he likes better in making a joint in large size pipe, cement or lead?

MR. ADDICKS—We use cement for both large and small pipes and find that it works all right in large pipes. I have used it for all sizes up to twenty inches.

MR. NORRIS—Has anyone observed any tendency of the gas to eat out the tar of the tarred yarn in the course of time? We know that in the use of tarpaulin on pipe the gas acts as a solvent of the tar and causes a leak all around the joint. I have heard that that is the tendency in the use of tarred yarn. I have used it both ways, and would like to know if anyone else has observed that tendency. I have known joints which have been in use for quite a number of years to become leaky, and the only explanation was that the tar had been eaten out by the gas and left the yarn honeycombed.

MR. PINKNEY—I suppose it is an exceedingly well known fact to all gas men that the expansion and contraction—more especially if the pipe happens to be between the low and high frost points—the contraction due to frost of course will at times pull the joint. That might be charged to the tar, or it might be charged to the frost.

MR. McELROY—I have about ninety miles of pipe under my care, and I do not think I have a mile with lead joints at present. I have never had any trouble with cement joints when the space was deep enough to hold a sufficient quantity of cement and it was properly driven in. I tried jute and thought that it would do, but found it would not answer. I now use the best American hemp packing, driven home tight, and have no trouble. When they introduced natural gas in Pittsburgh they tore up the mains all over the city, and my mains suffered greatly. The

following winter was very cold, and I had three hundred broken mains but I did not have one pulled joint. I always prefer a broken main to a pulled joint, for then you know where to find the leak.

THE PRESIDENT—In answer to Mr. Pinkney the Chair will state that in Toronto we have had a large number of lead joints drawn by the frost, so that the drawing is not peculiar to cement joints.

MR. PINKNEY—This matter has drifted into a very interesting subject. I question whether there is anything that can be brought up which would be more interesting at present than that. I would like to say to Mr. Addicks that I am here looking for information ; that is what my company is paying my expenses here for ; and I would like to ask him if he will tell me how those joints are made. I have been trying to make cement joints but have made a most glorious failure of it.

MR. ADDICKS—I think under the circumstances, and owing to the lateness of the hour, the matter had better be left to the Quarterly, and have a discussion there on this very interesting subject ; and possibly it may be a question for the Federation to consider in the future.

MR. CLARK—I desire to state an experience with lead joints that we are now having in Jersey City. I learned a few days ago from the man who is now testing Jersey City for leaks that they were discovering evidences of electrolysis on the mains laid with cement joints. The corrosive action is near the joint. The electrical current does not take its course through the cement, but goes from metal to metal through the damp soil or over the damp surface of the cement. Where he has examined lead joints he has not found this trouble. Evidently lead is a better conductor than cement. It occurred to me yesterday while the President was reading his address that if it is true that the current will not pass cement, but will leave the pipe and by-pass a cement joint, the remedy for electrolysis proposed by the President will not succeed.

THE PRESIDENT—We have lead joints altogether.

MR. CLARK—I mean that cement joints would not succeed in remedying the difficulty.

MR. THOMPSON—It is undoubtedly true that at such points as resistance is introduced in the line of the main by the use of such a cement joint as Mr. Clark cites, or by the method that was tried by Mr. Farnham, the current will leave the pipe and re-enter it at a point a short distance beyond, and at the point of departure of the current electrolysis will take place. I take issue with Mr. Clark in his reasoning with regard to the use of cement joints. I think we should endeavor to prevent electrolysis, not by the method which the President suggests, of increasing the conductivity of the pipes, but by decreasing it, and to that end the use of cement joints is about the best method one can employ.

MR. ADDICKS—I have taken up in Boston within a short time two six inch mains—one all cement joints and the other all lead joints—both laid within a year of each other. The six inch cement joint is intact, while the lead joint is badly corroded. Instead of having the sharp edge of the bell, it is rounded about the same as you see rocks affected by the corrosion of water in the course of time. The services were not in use—it was one of the useless lines—and the services simply had Ls and plugs in them. The top of the L is entirely eaten away, and the cast iron above is eaten away. That main never had any gas in it. The cement jointed pipe was supposed to be intact, but I ordered a piece brought up, and in cutting the pipe the scale came off, leaving it perfectly clear. Whether that fact is due to some acid which had eaten away the lead I am not prepared to say; nor am I prepared to say it is due to electrolysis; but I think it is the nearest to electrolysis that I have found in Boston. I must not omit to mention the fact that there was salt water present in the street within short distance. I think the way we will have to take care of that in the future will be to make our pipes poor conductors, and if necessary let the water pipes with lead joints take the current.

THE PRESIDENT—The Secretary will read the next question.

(4) *What is the best cement to use for making cement joints?*

THE PRESIDENT—Do you want to go into that? As there is no discussion, we will have the next question.

(5) *Can any one describe or mention any new apparatus or instrument useful in the line of gas testing or measurement?*

THE PRESIDENT—Has any gentleman any information on that point?

THE SECRETARY—For an answer to that question I would refer the gentlemen to the advertisements in the gas journals.

(6) *The Proceedings of the Association being copyrighted, what effect does that have upon papers published therein and read at the meetings?*

THE PRESIDENT—The Chair can answer that by saying that the papers belong to the writers, and that they can do what they like with them after the meeting.

MR. E. C. BROWN—Do I understand the Chair to say that notwithstanding the fact that the papers are copyrighted, the mere wave of the hand of the Secretary passes the copyright back to the author? The copyright rests in the Secretary of the Association. It cannot be passed to any one else except in a legal way. It is impossible for any one rightfully to print those papers without the authority of the Secretary for doing so.

THE PRESIDENT—I understand that after the meeting they are made the property of the writers, and that they can do as they like with them.

THE SECRETARY — The Proceedings are copyrighted, and such copyright is vested in the Secretary until after the papers have been read and discussed at the meeting. After that is done, the Secretary vests the right entirely in the authors of the papers. After a paper has been read and discussed at the meeting, the Secretary then in the regular way vests the right of copyright entirely in the author of the paper. So that after such papers have been read and discussed at the meeting, anybody who chooses to reproduce them has no other obstacle to overcome than simply ask the permission of the author. The Secretary has nothing whatever to do with them after that. He vests the right of copyright entirely in the author.

MR. E. C. BROWN—This is a very important matter to most of us. I would ask if it is understood that the Secretary will legally transfer all those copyrighted papers back to the authors? Is it generally so understood?

THE SECRETARY—The Secretary, as far as his action in copyrighting the papers is concerned, is prepared to back it up, but after they have been read at the meeting the right is vested in the writer, and there will not be the possibility of a question as to the author's right.

MR. E. C. BROWN—But that must be done by a regular assignment?

THE SECRETARY—Yes.

7. *An outdoor holder used for mixture of coal and water gas in northern climate has the horizontal side seams lapped down on the outside and they have become leaky. Is there any good method by which they may be made permanently tight?*

MR. SERRILL—I would refer the writer of that question for an answer to Mr. Findlay's paper.

8. *Why are holders built with horizontal side seams made to lap down instead of up on the outside?*

THE PRESIDENT—Is there any builder of holders here who will answer that?

MR. THOMPSON—*Are they built to lap down on the outside?*

THE SECRETARY—It is within the personal knowledge of the speaker that there are quite a number of holders built that way, and some of very recent construction, with the horizontal side seams lapping down outside; and when this question was sent in he took particular notice of all the holders he happened to see, and found a very large number built in that way. It seems to me that it is wrong. It seems to me that the joints should lap up on the outside, and then whatever paint or other material is put on would be retained by the joint, kept tight, and would not work out. Where the joint laps the other way, the condensation of gas, if there be any on the inside, and especially in the case of crude gas where there is sulphuric acid, the joint

would be eaten out, and it would be a hard job to make it tight and keep it so.

MR. FORSTALL—I think the idea in lapping the joints down is so that the projection will not hold water, as the holder comes up out of the water, and so prevent it rusting. I think that is the idea in making them lap down, but I think the idea in making them lap up is better.

MR. MAYER—I do not think it makes any difference, really, whether the joints are made to lap up or down. The idea in making the seams lap up is of course to catch the paint; but it is not supposed to make the holder tight by painting, so that it really makes no difference which way the laps go.

9. *What should be allowed as a general average for the shrinkage of Lowe water gas, in its change from the relief holder through the exhauster, purifiers and meter to the distributing holder, aside from that due to difference in temperature?*

MR. CLARK—It depends upon whether it is oxide purification or lime purification. If it is oxide purification, the difference is insignificant; it is way under one per cent.

10. *Can and will any one make known their experience with the prepayment meters?*

THE PRESIDENT—Is there any gentleman here who has had experience in this country with prepayment meters? It seems no one has yet had enough to make a statement on it.

11. *Does any gas company make a special department of attention to the proper use of its product by its customers, and the selection and arrangement of burners or appliances specially adapted for each set of conditions met; if so, how have results justified the plan?*

THE PRESIDENT—Has any gentleman had any experience in that line which he will state?

THE SECRETARY—While I cannot now name a company or state any experience with such a plan, it would be commended by common sense as an evidence of business energy and positively necessary in some form if the company is competing with other illuminants.

12. *To what extent are trees destroyed by escaping gas, and how does illuminating gas destroy the life of a tree?*

MR. CLARK—I have known of instances in which gas companies have had to pay for trees alleged to have been killed by gas; but I cannot tell, and I doubt if any one can, that the gas actually did it.

A MEMBER—In the case of the poisoning of trees by gas, it would seem that the sap is affected by the gas, and therefore it might be called a case of blood poisoning.

13. *Has any one used the slide rule principle of figuring the flow of gas through mains? If so, with what satisfaction?*

THE SECRETARY—There is one thing, which, although not exactly the old fashioned slide rule, yet is on that plan. It is a gas flow computer recently put upon the market. I presume most of the members have seen advertisement of it in some of the three gas journals. It is an arrangement which has already been used by quite a number of companies. My own experience with it, so far as I have been able to check it, has been that it comes closer in practice to computing the actual gas flow in mains, than any other calculating machine or formula that I know of. I refer to Cox's Gas Flow Computer.

MR. WM. HENRY WHITE—I wish to say, Mr. President, in behalf of the Committee on the President's address, they desire me to report progress, and request that they be permitted to print their report in the next number of the Quarterly. They are not prepared to report at this time.*

On motion of Mr. Lansden, seconded by Mr. Graeff, the Committee on the President's address was instructed to make their report to the Secretary, and that the same be published in the Proceedings.

MR. WHITE—When this Association met in the city of Washington ten years ago, we were the guests of our lamented friend, Mr. George McIlhenny, then President of the Washing-

* For this report see page 343.

ton Company. The Association met here at that time at his request, and knowing that it was probably the last time he could ever meet with the Association. I learned yesterday that his widow, after some eighteen months of absence, has returned to the city, and to the home which her husband had occupied with her. It seems to me it is due to ourselves, and certainly due to that lady, as showing her the love and respect which this Association and all the gas men of America, had for her husband, that our Secretary be instructed to convey to her in a courteous letter, the sentiments of high regard which all American gas men held for her husband, and the kindly remembrance in which they hold his memory. I therefore move you that the Secretary be instructed to write a letter to Mrs. McIlhenny, conveying to her an expression of their respect, and of their appreciation and remembrance of the great service rendered to the gas fraternity by her distinguished husband.

MR. LITTLEHALES—I second that motion.

THE SECRETARY—I will move to amend that motion by making it appoint Capt. William Henry White a Committee of one to do that correspondence. I make this motion for several reasons: First, because Capt. White was probably of all our members the most intimate with Mr. McIlhenny, and not only knew him best in his relations with the Association, but was also well acquainted with him in his family relations. And, while a letter written by the Secretary might be considered very appropriate, because it would be official, still I think it would be better to have a special Committee appointed to prepare and send the letter.

The resolution as amended by the Secretary was adopted, and the sentiments of the Association as implied in the resolution were verbally expressed to Mrs. McIlhenny by Capt. White, who subsequently confirmed the same in a letter, for copy of which see page 343.

FEDERATION.

THE PRESIDENT—The next business in order is the report of the Council on the matter of Federation. As Mr. Addicks is the Chairman of the Federation Committee, and it is the desire of the Secretary, I think it is eminently fit that Mr. Addicks should present that report; and if he will kindly come to the platform it will probably be a better position for him in which to say what he has to say.

MR. ADDICKS—Mr. President, and Gentlemen of the Association: The Committee on Federation which was appointed last winter by the President and notified by letter from the Secretary of the Association, met and organized in Boston at the time of the New England meeting. A plan was drawn up, and the Chairman was authorized to invite certain other Associations to appoint Conference Committees to meet the Federation Committee of this Association in Cleveland, in May last. Such letters were sent to the Secretaries of the Ohio, the Western, the New England, the Pacific Slope, and the Michigan Gas Associations. Between the sending of the letters and the meeting the time was very short, so that the Pacific Slope Association would have very little opportunity to reply. The Conference Committee met in Cleveland in May, and revised the plan of Federation which had been made by the Federation Committee in Boston. The Chairman of the Federation Committee was appointed a Committee of one to draw a Constitution and By-Laws for the Federation. The Constitution and By-Laws which you will find printed and on the seats in various parts of the hall is the Constitution and By-Laws which was submitted to individual members of the Conference Committees for them to express an opinion upon. I think it is not necessary to go into details. The matter was submitted to the Council, and the Council saw fit to submit the whole matter to the Association without any action on their part except as recommending certain amendments to the report of the Committee, and which the Association might take action on as they saw fit. Being a member of the Council likewise, the President has permitted me to speak for the Council in the matter. With this brief history

of the matter up to date, I presume the President will put the matter before you, and as you have it all in print I do not presume you wish to have it read at the present moment.

MR. COWDERY—I move that Mr. Addicks give the amendments as proposed by the Council, and that the printed matter be not read.

MR. BROWN—I second that motion.

MR. RAMSDELL—It seems to me it would be well for us to have this read. I understand that the amendments which are proposed by the Council are very few; and by reading the report attention can be called at the same time to the amendments which will then be more easily understood.

THE PRESIDENT—Will you have this proposed scheme of Federation read to you at the present time as a whole? First will you have it read out; if so, will you have it read as a whole or will you have it read by sections?

MR. COWDERY—If it is to be read at all let it be read with the amendments as proposed. I move that it be read with the amendments proposed, as a whole.

MR. BROWN—I second it.

The motion of Mr. Cowdery, seconded by Mr. Brown was agreed to, and the Secretary read the proposed Constitution and By-Laws as amended by the Council, as follows:

CONSTITUTION AND BY-LAWS FOR GOVERNMENT OF THE PROPOSED FEDERATION.

ARTICLE I.

SECTION 1. The title of this Federation shall be "The Federation of Gas Associations in America."

SEC. 2. The object of the Federation is to further the interests of the gas fraternity and the gas industry.

ARTICLE II.

SECTION 1. Membership in the Federation is not an individual membership, but is membership by Associations.

SEC. 2. Associations may become members of the Federation only by the unanimous vote of the members of the Federation, except the Associations named in Article II, Section 3.

SEC. 3. *The New England, Western, Ohio and American Gas Light Associations* may become *Charter Members* of the Federation by accepting at their respective annual meeting occurring prior to June 30, 1896, this Constitution and By-Laws; and by authorizing their Secretaries to sign the same before that date.

SEC. 4. Should any Association fail to pay its proportion of the expenses of the publication of the Journal by June 30th of any year, after 30 days' notice, such Association may be considered suspended from the privileges of membership until the amount has been paid.

SEC. 5. Any Association elected to membership must authorize its Secretary, and he must sign the Constitution and By-Laws before it is entitled to membership.

ARTICLE III.

SECTION 1. There shall be no officers elected by the Federation other than the Editor of the Journal.

ARTICLE IV.

SECTION 1. Association representation in the Federation shall be by standing committees, members of which are appointed by the Associations in the Federation.

SEC. 2. There shall be a Conference Committee composed of the Presidents, First Vice-Presidents and Secretaries (all ex-officio) of all the Associations members of the Federation. The function of this committee is the discussion of the varied events that may be from time to time of importance to gas interests, and that may invite the co-operation of the gas fraternity, thus obtaining concerted action when desirable.

SEC. 3. There shall be a Committee on Standards, Methods and Similar Designs, composed of members appointed by each Association in the Federation.

SEC. 4. There shall be a similar Committee on Scientific and Practical Experiments and Investigations.

SEC. 5. There shall be an Advisory Committee on the publication of the Journal, composed of the Secretary (ex-officio) of each Association in the Federation and of the Editor of the Journal.

SEC. 6. There shall be a Committee on Audit of Journal Fund, composed of the President of each Association in the Federation or his representative.

ARTICLE V.

SECTION 1. There shall be a Journal, published quarterly, entitled "The Journal of the Federation of Gas Associations in America," containing the annual proceedings of each Association in the Federation, together with committee reports, patents, current literature, new publications and other matters of interest to the Associations or the individuals forming the same.

SEC. 2. There shall be a Journal Fund.

SEC. 3. The cost of publishing the Journal shall be divided among the As-



sociations in the Federation in proportion to their respective total membership, but its cost shall not exceed two dollars, annually, to each member in each Association in the Federation.

SEC. 4. All proceeds from the sale of extra copies of the Journal, advertisements therein, etc., shall be credited to the Journal Fund.

SEC. 5. Each member of the Federation must furnish a copy of its own proceedings, endorsed by its Secretary, for publication in the Journal, and it may copyright its own proceedings.

SEC. 6. The Federation shall not be responsible for opinions expressed or matter contained in the Journal.

SEC. 7. It is intended that every individual member of every Association in the Federation shall receive one copy and one only of the Journal.

SEC. 8. Any individual member of any Association in the Federation desiring an extra copy of the Journal shall be furnished same at the price extra copies are furnished to the Associations. All other copies must be paid for as the advisory Committee may decide.

SEC. 9. The Editor of the Journal shall be elected by the Conference Committee. A three-fourths vote of all the Associations in favor of one candidate shall be necessary to secure an election. A unanimous vote of all the Associations at any time may remove the Editor from office. The Editor's term of office shall be three years or until his successor is elected. The pay of the Editor and any clerical assistance the Conference Committee may authorize, shall be fixed by them and paid from the Journal Fund.

The Secretary of the American Gas Light Association shall be the first Editor of the Journal, to date from July 1, 1896.

SEC. 10. On July 1st, every year, the Secretary of each Association shall furnish to the Editor a list of all its members to be used as a mailing list for the ensuing year.

ARTICLE VI.

SECTION 1. Any Association in the Federation through its Secretary by communicating with the Editor of the Journal, may inaugurate any investigation or movement by this act alone.

SEC. 2. The Editor will notify the members of the Advisory Committee of this request, and they in turn will bring the matter before the proper committee and the Council or the Board of Directors of their respective Associations. The data and results should be sent to the Editor and should appear in the Journal credited to the proper Association.

After the movement shall have been once started the committee (having the investigation in charge) of the original Association making request shall develop the lines of the investigation.

SEC. 3. The Association starting any investigation should specify the lines upon which the same should be developed, but this does not prevent investigation on other lines in addition thereto.

SEC. 4. Nothing in this plan is intended to interfere with the independent local government of any Association in the Federation; independent but co-

operative action on any subject by *each* Association from its *individual* point of view is what is aimed at.

ARTICLE VII.

SECTION 1. Each Association in the Federation shall make a provision in its Constitution or By-Laws that a vote may be taken on Federation matters by mail, when its Council or Board of Directors directs the Secretary to obtain such a vote.

ARTICLE VIII.

SECTION 1. There shall be maintained, by the Advisory Committee, in pamphlet or other convenient form kept to date from time to time by addenda, a record of all Standards adopted by the Federation. This shall be in addition to such matter in the Journal. The date of adoption by each Association of an original standard and the date of any change in same must be plainly shown.

SEC. 2. A charge may be made to members of Associations in the Federation for each copy thereof, and must be made to all others desiring copies.

ARTICLE IX.

SECTION 1. Committees when voting shall vote by Associations, each Association having one vote only.

ARTICLE X.

SECTION 1. This Constitution and By-Laws shall go into effect on July 1, 1896, if accepted at an annual meeting prior to that date by two or more of the Associations named in Article I, Section 3.

SEC. 2. Changes in this Constitution shall require a unanimous vote of the Associations (each taken at an annual meeting). When there are six (6) Associations in the Federation a three-fourths vote only will be required.

BY-LAWS.

ARTICLE A.

SECTION 1. Application for membership in the Federation should be made to the Editor who must promptly inform the Advisory Committee of such application; each member thereof should at once place the application before the Association he represents.

SEC. 2. No Association shall vote on the admission of a new member to the Federation save at an annual meeting.

ARTICLE B.

SECTION 1. The members on the Committee of Article IV, Sections 3 and 4, representing any Association, should be at least three in number on each committee. Each member should be elected for three years, and the term of office of but one member should expire each year.

ARTICLE C.

SECTION 1. When, by a three-fourths vote, the Conference Committee may consider it wise, there may be opened a committee, library and reading room in the city of New York; this shall be for all committees of, or individual members in the Associations in the Federation. A register shall be maintained at these quarters.

SEC. 2. Should this experiment prove successful, one year thereafter, like action may be taken and similar quarters may be established in the city of Chicago.

ARTICLE D.

SECTION 1. Changes in these By-Laws can be made by a three-fourths vote of the Associations, but when the number reaches six (6) in the Federation, a two-thirds vote shall be sufficient for such change.

THE PRESIDENT—Gentlemen, this very important report is now before you for your action.

MR. GRAEFF—In order to test the sense of this Association upon this matter as a whole I move that it be indefinitely postponed.

MR. E. C. BROWN—I second that motion.

MR. CLARK—I want to ask if under Roberts' Rules of Order, that is a debatable question.

THE PRESIDENT—I think it is not a debatable question.

MR. HARBISON—I move that the motion to indefinitely postpone be laid upon the table.

MR. AFRICA—I second the motion.

THE PRESIDENT—I believe that is a proper motion. It is moved by Mr. Harbison, seconded by Mr. Africa, that the motion to indefinitely postpone be laid upon the table. All in favor of that motion will stand until counted.

MR. LANSDEN—May I call attention to the fact that associate members of the Association are voting? I understand that only active members are entitled to vote.

THE PRESIDENT—No one can vote except active members. All but active members will please sit down. Those opposed to the motion will please rise. The Ayes have it. The motion is carried.

Not

MR. HARBISON—Now I move that the report of the Committee, with their recommendations as to amendments, as read by the Secretary, be adopted by this Association.

MR. AFRICA—I second the motion.

THE PRESIDENT—All in favor of this motion will say Aye ; contrary, No. The Ayes have it.

MR. GRAEFF—This motion is surely debatable ; and there may be those here who are prepared to debate it.

THE PRESIDENT—The resolution had been put before you were on your feet. Upon that ground I declare it carried.

MR. GRAEFF—Did the chair invite discussion of this matter ?

THE PRESIDENT—We have no disposition to force anything down the throat of the members of the Association ; and therefore I will withdraw my ruling, and the question can be debated.

MR. HARBISON—I move to reconsider the vote just passed so that the whole matter may come before us for discussion.

MR. ADDICKS—I second that motion.

THE PRESIDENT—It is moved by Mr. Harbison, and seconded by Mr. Addicks that we reconsider the resolution just passed, and that the matter be open for discussion. All in favor of that motion will say, Aye ; contrary, No. The Ayes have it. Now, gentlemen, you can proceed.

MR. McKEIGE—I do not keep in mind the figures read by the Secretary yesterday as to the cost of printing the Journal. Will he kindly state again how much that costs the Association ?

THE SECRETARY—The publication of the Quarterly Proceedings thus far—and I refer now to all four issues, that is for one year—the first issue contains considerable more than the others, the second was not quite as large, but the last two issues are what we expect it will be right along—those publications have cost us, including the cuts, and the expense of putting the numbers in the hands of members, nearly two dollars per page for publication of six hundred copies of each number.

MR. McKEIGE—How much in the aggregate for the year ?

THE SECRETARY—The whole thing has cost us about one thousand dollars.

MR. McKEIGE—Do I understand that this Quarterly is still to be continued?

THE SECRETARY—Nothing has yet been done looking to its discontinuance, that the Secretary is aware of.

MR. McKEIGE—Then the charge to the Association for membership in the Federation is about eight hundred dollars more. It seems to me, Mr. President, that we are getting altogether out of our line of business. This is not a publishing house. The people who have stood up for the gas business right along have been those connected with the gas journals; and why should this Association, or other associations, join together and start a publishing plant of their own? It seems to me that we are getting out of our line of business altogether. The people who have fought and bled for the gas business in this country—the two or three gas journals—I think it is due to them as well as to the business itself, that those journals be afforded all the latitude possible in getting before the gas people of this country not only the Proceedings of the meetings promptly, but every paper bearing on the gas business. I heard here yesterday that the proceedings of this meeting would not be published until next January. Good Lord! It will be ancient history. By that time we will have forgotten all about it. There are three or four hundred members of this Association who will get in the Quarterly a report of our proceedings; but I understand that there are eleven hundred gas companies in this country. Only four hundred of them are represented here. The other companies are too poor to send a representative here; they are too poor to subscribe for the Quarterly; and they do not get any of the benefits from all these discussions which we have.

It seems to me we ought to give up the publishing business and stick to our own. Let the gas journals attend to that.

MR. E. C. BROWN—Mr. President; I would like to be heard on this question. It is a vital one to me, as I believe it is to every member within the hearing of my voice. I trust my associates upon this floor will not impute selfish motives nor attri-

bute my position in this matter to a desire on my part to disturb the harmony of this meeting ; such assumption would do me grave injustice.

I am opposed to Federation as presented here to-day ; I oppose the whole tenor of such proceedings because in my judgment I fear this Association is about to commit itself to a measure the phases of which are clearly without the functions of a society of the character of this, and because I believe the project inimical to the general good for which this Association was called into existence.

It has been said that articles bearing the imprint of Boston pass current everywhere ; for I would have you know that Boston exercises nice discrimination, and most articles, whether of commerce or of a literary nature, emanating from that effete locality stand high in the good opinions of the world at large. But, sir, I will undertake to say that not all things of Boston production bear the seal of "The Hub of the Universe." Two years ago this month a paper was read at one of our meetings ; a paper that received at the time marked attention, and has since attracted more general notice than is customarily accorded to papers read at our meetings. It was the production of a gentleman whom we all honor for his eminent manly qualifications no less than for his ability as an engineer. He is indeed a shining example of the thoroughly equipped member of the gas fraternity. Yearly since this paper was read, first at one and then at another of our sister societies, this scheme of Federation has been dealt with—by committees. Only now have we presented to us a series of "Articles" which this slender minority of our membership is asked to consider and pass upon because they come to us as recommendations of the Council. I feel that the meager membership now present, no matter what the rules may be, has no right in equity to decide for all a question of such magnitude, and fraught as it is with so many intricate problems—certainly not when opportunity can be so easily offered to obtain a consensus of opinion.

Gentlemen, this Association is now asked to make the American Gas Light Association the entering wedge to a scheme that is so woefully overloaded that even now it well nigh topples because of its own illy balanced weight. We are asked as an

Association to pledge ourselves to carry out problems that involve the expenditure of unknown sums of money and assume increased responsibilities for enterprises that have not as yet reached the experimental stage ; unless the slow and ponderous methods associated with our proceedings of yesterday and to-day as an effect of our "Quarterly," are considered suited to the best interest of this and kindred societies. Sir, I object to this society engaging in a commercial business. I protest against this Association taking any action that will commit it even as an influencing agent to induce sister societies to follow—I certainly know not where nor do I believe the most ardent supporter of Federation can say—whither ?

Few, and a very few, members know to this moment that the regular gas journals—those legitimate publications that have stood sponsors for gas and for the actions of gas men—can now no longer publish detailed reports of the proceedings of this Association. Why ? Because the Council at our last annual meeting recommended that this time honored custom should be abrogated ; that the papers as well as the discussions read before you should thereafter appear only in the "Quarterly" publication of proceedings. My friends, I ask, is this just requital for past obligations ? I ask in the name of progress, is this the way to extend and broaden the scope of our affairs ? I answer emphatically, no !

Whence comes this idea of exclusion and seclusion ? What precedent has been found in this or other lands among kindred societies to mark the channel for such procedure ? We look to England in vain for the slightest semblance for such a course. There the journals are recognized exponents of the industry and accorded the right to publish every part and parcel of the proceedings of Great Britain's numerous gas institutions. In France a like condition prevails. In Germany the utmost liberty is extended the technical press ; so also in Holland and in Austria as well.

The time is well within the recollection of many now present when members of this Association complained because a gas journal extended its reports of the deliberations of this society over a period somewhat longer than was considered advantageous to the welfare of this Association. This complaint,

too, was made in the face of the fact that the publication referred to had supplied the needs of this society during a time in its affairs when its empty treasury would not admit of its doing for itself. As will be recalled our respected Secretary informed this meeting no longer ago than yesterday, that no part of the past two days' discussions can appear in print before the January number of the "Quarterly." If this shall be acceptable it offers a most striking commentary on the changeability of the human mind. Gentlemen, I wish to ask, is this an eleemosynary institution? I wish to know, does this society believe that the manufacturers identified with the gas industry of this country should be made to pay tribute to an organ of this Association while every man of them will tell you he has no need to announce his wares therein, and would only do so because "discretion is the better part of valor."

What is the basis of this "Quarterly?" Gratuitous contributions from the pens of men who seek to assist their fellow-workers by recital of the writers' experience and observations. I refuse to believe that the liberal spirit which induces men without pay or expectation of reward beyond the thankful appreciation of their associates—I say I refuse to believe that any one who prepares a paper for this or any other Gas Association harbors the disposition to withhold the result of his labors from the natural channel through which that result can gain the widest publicity. It is true that the Council in its recommendations as read yesterday, appear to make an attempt to expunge the copyright on papers that have been published in the "Quarterly," by vesting the proprietorship to such papers in the author; but, gentlemen, the member of Council who penned that recommendation was either unacquainted with the laws governing copyright, or he desired to appear to give what was not to be given; for a mere wave of the hand will not suffice to transfer back to an author what is legally registered in the office of the Librarian of Congress in the name of another. No, sir; no change whatever, no modification in the slightest degree, has been recommended by the Council that grants the gas journals a single privilege beyond that right afforded by last year's action, and that gave absolutely nothing. I am willing to believe that the Council deemed it desirable to do something

in respect to this matter ; but, as the record stands to-day it accomplished—well simply the most stupendous piece of infinitesimal generosity ever to come under my notice. Gentlemen, it is indeed a poor master who says to the good and faithful servant, to him who has stood shoulder to shoulder in the thick of battle, to him who has offered encouragement in days of darkest adversity, to the one who in sounding praises delicately glossed over infirmities—I say that it is a poor master who now says to that steadfast and faithful friend, “I need you no longer, for I am grown strong and prosperous. Get thee hence, go !”

Sir, we have reached the fork in the road in the affairs of this Association ; two ways now open before us ; one a broad, natural highway, an avenue free from the rocks of disaster, and along whose course the lights of advancement burn brightly. The lights are the lights of Truth pointing the way onward to greater triumphs. The other—I will not call it a road, it is but a mere mountaineer's trail ; its way is devious and filled with the apples of discord ; and at its end are insurmountable breakers ; a little further—chaos !

Mr. President, let the high lights of Truth shed the rays of justice, of fair play, of harmony, of good fellowship and advancement over the deliberation of this to us most vital question.

MR. McILHENNY—Mr. President, it is very evident from the reading of this report, and the arguments made that it is a question that has decidedly two sides to it ; and every member of this society, as upon any question that is worth discussion, ought to declare himself as to what side he is on. For one I am against Federation. I think the whole thing is a mistake. I remember very well when I was a young gas man in a country town, sitting in the office, how eagerly and how sincerely I read what the older men were saying in the gas meetings, from the journals. I did not have to wait three months for it then. I could read it, and act upon the information when the matter was fresh in my mind ; and I was benefited by it as you will never be benefited by any such Quarterly. It is impossible. As Mr. McKeige said a while ago, we will forget all about it. In the publication of what is done at these meetings of the As-

sociation we want to benefit those who are not in attendance just as much as we want to benefit those who are in attendance. I think that we are broad enough, that we are liberal enough, to be willing that the Western Association shall be benefited by our Proceedings. This Federation scheme is a measure that cuts them out, unless they subscribe for this journal. Now they can get this information, as all the gas men of the United States can get it, from the Journal; and they do not have to want for it, and they do not have to pay extra for it. There happens, as it seems to me, to be another matter worth considering. I hope that I would be one of the last men in the Association to stand in the way of improvement. As an old member of the society, as an old gas man—and the older I get the more I think of these gentlemen who meet here from year to year; I love to look in their faces; I love to see them returning here year after year, and especially the older members; it is a great gratification to one who has been so long connected with the Association as I have been, to meet them here; and I would not say one word in opposition, and I do not want it to be understood that I am opposed to anybody in this matter; but I think that it is mistaken judgment to carry out this scheme; and we all know very well that activity is not always energy, and that change is not always improvement. We have got along splendidly on what we have had; and we owe the men who are publishing these gas journals a great deal; they have been great educators for us, and we owe them a great deal; and we should hesitate to do anything which will do them harm. That is the reason that I am doing, as I am not in habit of doing, in these meetings—expressing my opinion against this thing. I hope it will not be carried.

MR. ADDICKS—Speaking for myself alone, I am very glad to hear this active discussion; and I am glad to hear all the things that can be said against Federation. I sincerely appreciate all that Mr. Brown says with regard to the gas journals. But Mr. Brown is not perhaps as familiar with this scheme as I am, and as I do not wish to take any unfair advantage of him I would like him to point out the particular things in the Federation which cause his remarks. As I understood both the last speak-

ers the burden of their objection is in the fact that the gas journals will not have the opportunity of publishing the Proceedings of any of the Associations in the Federation. Let me read to you the clause which bears upon that subject. I will read you first as originally planned, and then read it with the additions made by the Council. Article 5, Section 5, originally read: "Any member of the Federation may copyright its own proceedings." Now, why was that done?

As the Council have amended it that section reads as follows: "Each member of the Federation must furnish a copy of its own Proceedings, endorsed by its Secretary, for publication in the Journal, and it may copyright its own Proceedings." You will observe that the editor of the Journal by this plan has absolutely no power over the Proceedings of any Association in the Federation. If he happens to be the Secretary of some particular Association (as would be the case with the first editor only, very probably) he would transmit to himself the Proceedings of that particular Association. Otherwise he has no control over the Proceedings of any Association. Each Association can do what it pleases with its own Proceedings. It may publish them in one journal if it sees fit, it may publish them in all the gas journals if it sees fit, or it may publish them in none of the gas journals if it sees fit. The Associations to-day have that power; and in order to answer the very question that Mr. Brown brings up, it must be expressly provided that the editor of the Journal can have no control over any of the Proceedings.

MR. E. C. BROWN—It is not the question of editorship; I am against it on general principles, and because I think it is entirely outside of the province of a Gas Association to engage in any commercial business. I am opposed to it on the same grounds that a most unusual proceeding occurred here to-day, when this Council had a paper withdrawn from it, which they had accepted. I know nothing about the merits of that paper; I did not hear it; but I think it was a most unusual proceeding. Why? Because there were two objectionable features in that paper. One, the competition which that paper favors. The members rose up in a body and said: We must not let it go out to the world

that we do not want competition. Now you are sticking the knife right up the back of the gas journals which have served you so well.

MR. ADDICKS—I can understand the end of the argument. I want it distinctly understood that the value in the Federation, if there is a value, will only be brought out by a full discussion. I do not believe that anything should be started without looking to the end of it. As I understood Mr. Brown, one of his chief objections was to the fact that the journals could not have the entire proceedings of some particular association, or if all the associations went into the Federation, that they could not have the proceedings of any of the associations in the Federation. That is what I gathered from his remarks. But it is not so provided, nor is it so intended in this Constitution and By-Laws. Mr. McKeige, I believe it was, spoke of \$800. I do not know what that \$800 referred to. I would like to have him explain to me what he referred to.

MR. McKEIGE—Is not the cost of the Journal fixed as two dollars per year to each member of the different associations? And does not each member have to pay that, in addition to paying for the present Quarterly? We are already paying \$1,000.

MR. ADDICKS—The cost of publishing the Proceedings will be divided among the various associations in the proportion of their membership, and it cannot exceed two dollars to each member of each association in the Federation. So that two dollars multiplied by the number of members in this Association will represent the total cost of the Proceedings to this Association. If we are paying a thousand dollars now we will save two hundred dollars on the Proceedings by having them published by the Federation. That is on the supposition that the Federation scheme is adopted by these associations.

MR. McKEIGE—I asked the question if our own Quarterly is to be continued?

MR. ADDICKS—Naturally if there is a Federation we would send our Proceedings to the Journal of the Federation.

MR. McKEIGE—We are printing them now, and some one must be authorized to discontinue it.

MR. ADDICKS—At the present time we are running the Quarterly ; but if our proceedings are put in the Journal of the Federation, under this Constitution and By-Laws, we would certainly cease to run the Quarterly on our own hook.

MR. McKEIGE—But you do not say so ; and you have got to take things as they are.

MR. ADDICKS—I cannot see the object. You must remember that we are discussing this at the present time. That same question coming up in another association, they might take the same ground there. But when we go into the Federation, if we do, the extreme cost of publication is placed at two dollars per member ; and what will be the cost to this Association for publishing its proceedings ?

MR. McDONALD—Like Mr. McIlhenny, it is not often that I take part in the discussions in this Association, but I cannot help but feel that this is a matter of vital importance to every member. Therefore I take the liberty of saying what I feel ought to be said. I do not agree with Mr. McIlhenny altogether in his position as to this proposed arrangement ; and I do not quite agree with the arrangement that is desired to be brought about. I do not agree with the arguments that have been adduced here this afternoon. I think they are of no importance whatever, and do not bear upon the really important matters connected with this scheme. I believe that the people who are trying to introduce Federation into the Associations of this country are doing it with honest purposes, and in the belief that it will be for the best interests of the Association ; in the hope that the discussions will become more valuable, that the results will be more lasting, and will therefore do the gas fraternity more good. On the other hand there are a number of members who do not believe that the method it is proposed to adopt will be as beneficial to the Association as the past arrangement was. It seems to me this is the true ground upon which we should discuss this project—as to whether this adoption will be better for the Association, or worse. I contend that the matter of a few dollars, more or less, expended by this Association counts for nothing ; what we are all seeking is a permanent good. I believe that I voice the feeling of every member of

this Association when I say that I want nothing but what is best for this Association. Now, gentlemen, if every member of this Association was a carefully educated technical man there is no question in my mind but what Federation would be largely to our interest. If, on the other hand, a majority of our members are not men of that character, but are men who have grown up in the rough and tumble of their experience, and who come into these meetings seeking to get the benefit of them from what they hear and see, and from grasping the hands of their fellow members, and in the freedom of association that we have had heretofore, then I think they would not get as much good from this arrangement of Federation. As I understand the scheme it is proposed to publish the proceedings of all the associations in a Quarterly, similar to the way the proceedings of this Association have been published during the past year. I know there is a great deal of feeling against that plan. I think you will have noticed that every man who has spoken on this subject feels very strongly. For a time I feared there was going to be some effort made to cut off discussion—which would have been fatal. I believe that every member of this Association desires to do what is best. If you will satisfy him that this scheme is for the best interest of this Association, then without question he will vote for Federation. Satisfy him that Federation is not best for the Association and he will certainly vote against it. But do not let us go into petty arguments. While I think as much of our journals as any man does, yet I do not think that they are all that we are to consider here. I think that what the members of this Association desire, what is best for them, and what they think will bring about the highest good of this Association, is what we need, and what we all wish. Let us argue this question upon that line, and do not let us talk about a few dollars of expense, or discuss whether one paper or another shall be permitted to publish our proceedings. The papers always have published them. Now we are considering a change. Shall we change? That is a question which I think wants to be carefully considered. I think I may go a little further. I have no desire to say anything offensive, but I do think that the proceedings of the present meeting have to a certain extent discouraged members in respect to the matter of

Federation. There have been two papers, and really only two papers read and discussed in this Association to amount to anything ; and one of those was finally expunged from the records by the action of the Council. That is not what we have been accustomed to.

THE PRESIDENT—Let me say that the Association itself decided not to discuss these papers, and they decided that they should not be read. There was no forcing the matter.

MR. McDONALD—I understand that, and I did not intend to insinuate that there had been. But I do mean to say that two papers, one of which was expunged, took up so much time of the Association that the other papers had to be passed over very hurriedly because some of the members were anxious to get to the discussion of this scheme of Federation.

THE PRESIDENT—One reason why we have not given so much time to consideration of the papers as they were entitled to is because the members of the Association were not here in time to take part in the discussions.

MR. LITTLEHALES—I would like to say one word. A I understand it each member retains control over his own paper after having presented it to the Association, and so there is nothing in the world to prevent him handing a copy of that paper to any or to every one of the journals. If we were to cut off that sort of thing I would be as strongly opposed to it as any man in the room ; because I think it is a very desirable thing that every member of the Association should get the papers shortly after they are issued. We can get them easily, as it seems to me, unless the members who submit papers choose to withhold them. That is the way it strikes me. I do not see what objection there can be to their furnishing their papers to the journals.

MR. FODELL—I do not see the necessity for any such great haste in debating this matter this afternoon—in almost the last minute of the meeting. The scheme seems to contain a great deal that has not been duly considered, judging from what has been said here this afternoon ; and it seems to me that many of the points have been overlooked. I move that the whole sub-

ject matter, and the consideration of the subject, be postponed until the next annual meeting.

MR. EGNER—I second the motion.

THE PRESIDENT—There is now a motion to postpone the further consideration of this motion until the next meeting.

MR. RAMSDELL—Is that debatable?

THE PRESIDENT—It is not debatable.

MR. CLARK—Is the President certain in his ruling—that a motion to postpone to a certain time is not debatable?

THE PRESIDENT—I think it is not.

MR. CLARK—I think it is.

MR. ADDICKS—Was it stated that it was to be until the next meeting?

MR. E. C. BROWN—I move that we adjourn. (Several members—"No;" "No.") Well, I will withdraw the motion.

MR. HARBISON—It appears to me at this point, as a member of this Association who has been a pretty regular attendant on its meetings, and who has been somewhat interested in the business of making and selling gas, that it is becoming in this Association, as it is in some others with which I am concerned, a pretty serious question whether the members of the Association who are practically engaged in the business of lighting their respective cities and towns really know just what they are doing, or what they come here for. Are we coming here to be ruled and guided continually by two or three representative so-called gas journals? I think we have had enough of it; and if this is to continue I am ready for one—and there are a good many others in the room who are with me—to organize a new Association, whose members shall be practical gas men; and there will be nobody admitted as members except those who are practically engaged in the business. Then our time will not be taken up and wasted in this way when we come to these meetings. We leave our homes and business, some of us come a long ways, and spend much of our time in attending the meet-

ings, but for the most part fail to accomplish the purpose for which we came.

MR. FORSTALL—I rise to a point of order. I do not think the speaker is debating the question before the house.

THE PRESIDENT—We do not desire to limit discussion, but it must be confined to the subject at issue.

MR. HARBISON—I beg pardon if I have transgressed the strict rule of argument; but there has been great liberality shown to those who have occupied so much time before; and I will endeavor to confine myself strictly to the question of Federation, which I understand is before us. But when a member attempts to indefinitely postpone a matter, and so prevent me from having a word to say on the subject, I think it is not right. I want free discussion for everybody. I want everybody to have the opportunity of expressing his opinion. On the question of Federation I wish to say that I am in favor of it.

MR. THOMPSON—Is not the motion before the Convention to postpone indefinitely?

THE PRESIDENT—It is a motion to postpone the consideration of the subject to another date; and your argument, Mr. Harbison, must be to show why it should or should not be postponed to another date.

MR. HARBISON—Then I will try to speak to that subject, and to that alone. I am opposed to a postponement because I think that since the matter was first brought to our attention we have had sufficient time to consider the question. I am afraid that a good many in this room do not distinctly understand—and I am not sure that I do, but I think I do—just what is meant by this proposed scheme of Federation. It is intended to unite the various gas associations of the country for the one grand object of investigation on matters pertaining to gas interests which may be presented at the meetings; and to get a consolidation of influence and interest in all such matters, so that there shall be concentration of effort in the way of investigation in matters pertaining to our business. I hope there will not be any postponement of it. We have had time enough to consider it.

The longer we consider it the more time is wasted in these meetings. We can decide it either one way or the other by our vote here this afternoon ; and I hope it will not be postponed. I apprehend that I have not given the subject any more attention than the average member has done, but I am now quite ready to vote on the question ; and I hope that it will not be postponed.

MR. LANSDEN—I wish to ask for information with regard to this matter—whether what this Association does binds this Association only ?

THE PRESIDENT—That is all.

MR. LANSDEN—The proposed Federation consists of several other associations ; one of which has only about forty members. Does the one vote of that association carry the same weight as the vote of this Association ?

THE PRESIDENT—Yes.

MR. LANSDEN—What concentration of our ability as engineers, what concentration of our discoveries, can be accomplished in any such way ?

THE PRESIDENT—We are now on the subject of postponement. You must confine your remarks to reasons as to the postponement of the matter.

MR. LANSDEN—You, Mr. President, and you, my fellow members, see the feeling that exists on this subject this afternoon. Now would it not be wise to wait until we hear from some others who are to take part in it, let the matter be talked over, and be brought up another year and in the meantime see what the sentiment is in the other associations of which it is proposed to make this Federation. I think it is wise to put the matter over to another year.

MR. ADDICKS—Two years ago, in Boston, a paper was read on “A Gas Association and Its Members.” The subject was discussed the year afterwards, and a committee was appointed by this Association. A report on that subject has been made to this Association. It has come before this Association at three sessions. I fail to see why it should be postponed to another session. If it is so complicated that it requires four sessions of

this Association to consider this question, it will probably require four sessions of each of the other associations to consider it. I do not see how we can go before the other associations leaving this thing in the air, and expect them to consider it seriously. I am very much opposed to any postponement of the question. Personally I would prefer to see this Association, having gone forward in the matter, stop now, rather than postpone it to another session. I trust that it will not be postponed, but that it will be finished at this session and at this time.

THE PRESIDENT—Are you prepared to vote? We must cut down the discussion for lack of time to continue it. It has been moved by Mr. Fodell, seconded by Mr. Egner, that this question be postponed until the next meeting of the Association.

The question was put on the motion to postpone, and by a standing vote it was lost.

MR. HARBISON—Now, Mr. President, I move that the report of the Committee, with the recommendations of the Council, be adopted by the Association.

MR. BUCKMAN—I second that motion.

THE PRESIDENT—It is moved by Mr. Harbison, seconded by Mr. Buckman, that the recommendations of the Council be adopted, and that this scheme of Federation as proposed to the Association be now adopted. All in favor of that motion will say, Aye; contrary, No.

MR. E. C. BROWN—I call for a roll call, or a division.

THE PRESIDENT—The Ayes will stand. The Noes will stand. The motion is lost.

THE SECRETARY—Mr. President, if I may have the privilege of the floor I would like to say a few words. I have been somewhat connected with the Quarterly since it was started, which was but a very short time ago. The point was made by one of the members that for the publication of the Proceedings of this Convention we would be obliged to wait until next January. The question was asked me when the next issue of the Quarterly would be—whether in January. I answered that it prob-

ably would be. But it is entirely within the discretion of the Association to have it published at any time before if they please. I will put it out next week if the Association desires it.

It has been said that the Federation scheme would be adopted by a minority of our Associations if it were passed at the present time. I think it would be quite safe to say that in order to have it passed by a majority of the Associations the most feasible way would be by a mail vote, through the President, or through some Committee.

Again, it is said that Federation would be the entering wedge—

MR. FORSTALL—I rise to a point of order. What is before the meeting? There is no question before the meeting as I understand.

THE PRESIDENT—You are debating a question that has already been passed upon.

MR. FORSTALL—Then there is no question before the meeting at present?

MR. GRAEFF—I move that the Secretary be allowed to make any remarks he pleases.

MR. THOMPSON—I second the motion.

THE PRESIDENT—Mr. Graeff has moved and Mr. Thompson has seconded the motion, that the Secretary be heard. Is it your will that the Secretary be heard? Those in favor of the motion will say Aye. Now proceed, Mr. Secretary.

THE SECRETARY—It has been said that Federation was an entering wedge for something—but for what was not understood. Reference was made to the expenditure of unknown amounts in various schemes that no one could tell the ending of. Now, what was that based on?

MR. McKEIGE—Are you speaking to me?

THE SECRETARY—To the members generally. To you among the rest.

MR. McKEIGE—We paid \$1000 last year, and if this publication costs us \$800, that will make \$1,800 that we will have to pay hereafter.

THE SECRETARY—The gentleman is laboring under a serious misapprehension. If the question of Federation had been studied by him I think he would have understood that it was intended that as far as the publication of Proceedings is concerned in connection with Federation, the whole plan, in sum and substance, is simply this: That the associations will pool the expense of publishing the Proceedings. I have here a magazine which is the Journal of the Association of Engineering Societies; that is an association of societies which, so far as the publication of Proceedings is concerned, is very similar, and in fact almost the same as was proposed for the associations of gas engineers, if we have a Federation. That has been going on for some years and the number for July, 1894, completes the thirteenth volume. Certainly that is not a failure. Certainly the members of that association do not consider it so, or they would have abandoned it long ago.

I stated that the cost of printing our Proceedings was, in round numbers, for the four numbers already issued, about one thousand dollars. It should be borne in mind that the first two numbers were large and contained the report of Proceedings of the Association for the years 1892 and 1893—issued in essentially the same form that we have issued them before, except only that the report for each year was in a separate number, and that the volumes were not bound in cloth. The Quarterly, so far as the Association is concerned, begins with the July number. Previous to that there was no difference in the publication of the Proceedings of this Association from what they had been before, except the interval of emission, and style of binding, and the fact that but one year was contained in each issue. The form throughout is the same as had been used before in the bound volumes, which I presume all the members have. If the gas associations of America should combine in a Federation which, among other things, shall publish the Proceedings, then the Proceedings of all the associations would be published in a Journal of the Federation very closely similar to this Journal of the Association of Engineering Societies. The very title of it is almost the same. Our Federation is really an association of associations. Our associations are really societies—there is very little distinction there—so that the Proceed-

ings would be in very similar form. It is not therefore a new thing ; it is not an untried experiment. The cost to the Association would be approximately \$800 then, while the cost to this Association of printing this Quarterly as it was intended to carry it on, provided the Federation scheme did not pass, and there was no other change in any respect, will be presumably about \$900 per year. If the Association went into the Federation it would cost us about \$800, undoubtedly it would not continue to run the Quarterly in addition to going into the general publication by the association of societies.

One of the speakers said that he did not know where Federation would lead to. If he does not know where it would lead to he surely has a very indistinct idea of what it means. If the scheme of Federation is really started there can be little doubt what it will lead to, if it is adhered to. There are but two essential points in it, and they are really combined in one ; and the whole thing is expressed in one word, co-operation. The co-operation of societies in professional investigation of subjects pertaining to the industry is more an essential point of the Federation scheme than is the publication of Proceedings ; and the publication of the Proceedings is more a matter of convenience than it is an essential and vital point to the scheme of Federation. With all due deference to time-honored customs—and I revere them as much as any man present—it certainly is a fact that if only time-honored customs were always adhered to, civilization would immediately be at a stand-still, and there would be no advance.

Reference has been made to tribute said to be extorted from manufacturers. There can be but one way in which that remark can apply ; for the pockets of manufacturers could not be touched by the publication of Proceedings by the Federation in any different way from that of other members, except in the matter of advertisement. If the publication should contain advertisements there is no manufacturer who would be bound to advertise ; but I admit very freely and candidly, and am pleased to know the fact, that any advertiser seeing his competitor's advertisement in any periodical publication would be glad to get there along side of it, and to have equal advantage if there was any. If there was no advantage in it then cer-

tainly he would have no sensible reason for putting his advertisement there.

There is another point in connection with advertising, and the idea of compelling tribute from manufacturers, and that is that manufacturers would feel bound to support such a publication by their advertisements. If there is no direct or indirect advantage to be gained, then he goes there for a sentimental reason; and if he goes there on such grounds then I claim that any man who will bleed his pocketbook for a sentimental reason in an entirely unreasonable way, simply admits that he has not got nerve enough to manage his own business to his own advantage. There is no compulsion whatever about advertising, and no man should be thought less of if he did not advertise.

The question has been asked—What is the Quarterly? The Association at its last annual meeting adopted a recommendation of the Council that the Proceedings should be printed in quarterly form, and that certain matters might be admitted in the Quarterly in addition to the papers read at the meetings. You have received copies of that Quarterly. It speaks for itself. If it says nothing, and is worth nothing to you, discontinue it. It is the publication of the Association, and the Association can stop it at any time. The only things, besides the Proceedings, that have been admitted to the publication so far, have been the indices of technical literature, a list of new publications issued, and a list of gas patents. If these things are not worth having, or if it is undesirable to have them there, let them be expunged. The Association has simply to say so and it will be done.

One of the speakers referred to the relation of the matter to the gas journals. Gentlemen, that is a very serious question. It is one that should engage the attention of every man in the Association. Undoubtedly every one who has been here during the discussion cannot fail to have noticed the great emotion of some of the speakers on the question. Such emotion must indicate intense feeling. There has long been a question behind the scenes, as well as before the scenes, in this Association concerning its relations to the technical gas papers. That question is now revived in considering the relations of the quarterly publication of Proceedings to the technical gas papers. The first

and leading point that has been touched upon in the consideration of this question has been that this Quarterly Proceedings—or, as seems to be supposed, the Journal of the Federation which would contain the Proceedings of all the societies published in the same form—would take in matter that would thereby be withheld from the pages of the technical gas press. I myself favor, and to a very large extent, and I am speaking now as an individual, I favor to a large extent the publication of the Proceedings of this Association in the technical gas press. The technical gas press is run for dollars. If there was no money in it they would not run it. Their revenue presumably comes from two sources—from advertisements and from subscriptions. From their advertisements their revenue is undoubtedly large, and deservedly so. Their subscription lists depend entirely upon the value of the body matter in the papers; and that depends entirely upon the ability of the managers of the paper to produce and present to the fraternity such matter as shall be worth reading. What percentage of the matter that appears in those journals comes from the gas associations, or is made up of the Proceedings of gas associations? Wipe out from each one of those three publications everything that is part of the Proceedings of the associations and do you not have just as good and respectable a paper left, if we have one now? Suppose for the sake of the argument that everything relating to the Proceedings of the Association were to be removed from the columns of the technical gas press of this country, what would be the injury to them? It would be claimed that matter that was of great value to the industry at large would be withheld from their pages, and consequently from consideration by the industry at large in this country and in foreign countries. If all those Proceedings of the associations were withheld from the gas press it might be argued that the value of the gas press would be reduced accordingly to the members of the association. I think that it is an entirely wrong conception of the matter. Their value would not be reduced at all—supposing of course that each association published its own Proceedings—because the members would then get no less through the journals than they are getting now, except their own Proceedings, which they get in another form, and the value

of a subscription to the technical gas press would not be reduced. If the Proceedings were not to appear at all in the technical gas press (and I do not wish to be understood as saying that they are not to appear ; I am only assuming that now for the sake of the argument), then there would be a hole in their manuscript for publication ; and is it to be inferred that as business men they would not hustle to fill up that hole ? And I will venture the assertion that they would do their utmost to produce matter in their pages that would equal the matter furnished heretofore by the associations, and, consequently, there would be an increase in the value of their papers. It is argued that our industry is extremely limited, and that the field is very limited ; and that, therefore, the technical gas press should have encouragement from the associations in every way. I grant that. I subscribe to all the gas journals and shall continue to do so. I think it would be a sensible thing if every gas man in the country subscribed to several of them. He would gain by it, whether they published the Proceedings or not.

With regard to the papers written for the Quarterly I want to say that in the last two issues we have had two papers that were reprints. Why ? Because they were valuable papers as matter of reference. They had already appeared in the technical gas press ; and when permission was asked of the associations before whom they were read to re-produce them, there was no objection made. One other paper has been presented in the quarterly publication, and that was the paper written by a non-member, at the request of the Secretary.

Gentlemen, I wish to say, right here and now, that so far as my personal connection with the present Quarterly or with the proposed journal of the Federation of gas associations is concerned, I do not personally desire to have any office pertaining to it. I have got enough work and have no axe to grind. There are no dollars in this thing for me. The men who have preceded me as Secretary of this Association know very well that there is not much in any way to be gained in the office of Secretary. In regard to the Quarterly I have received my instructions from the Council, and have carried them out as best I knew how. I would be quite satisfied to put in my resignation

as Secretary of the American Association, and to let some other man take my place ; and then if this Federation scheme ever should materialize he may be the editor of the Quarterly ; and then I will not have any load to carry, and will have no fight behind the scenes with the editors of the gas journals. Gentlemen, I thank you for your kind attention.

THE PRESIDENT—If I had not already given my opinion, in my address, regarding our Secretary and his work upon the Quarterly, I would do so now. But having done so then I do not consider that further remarks on my part are necessary. Is there any further business before the Association ?

MR. CLARK—Is it not in order at this time to discharge the Committee ?

THE PRESIDENT—It is.

MR. CLARK—Then I move that the Committee on Federation receive the thanks of the Association for the very great and intelligent labor they have put upon this matter ; and that they be discharged.

MR. GRAEFF—I second that motion.

MR. HARBISON—I hope that Mr. Clark will kindly withdraw his motion for a moment, and permit Mr. Egner to make a motion. It may do away with the necessity of Mr. Clark's motion.

MR. CLARK—I will withdraw it.

MR. EGNER—The motion I wish to make is for a re-consideration of the vote by which this was laid aside, and to postpone the discussion until next year. We will all be better prepared then to take this up and to vote on it.

THE PRESIDENT—Mr. Egner moves a re-consideration of the vote on the passage of the report of the Committee—which was lost. He moves to re-consider that vote. Does anyone second that motion ?

MR. CHAMBERS—I second the motion.

MR. LANSDEN—I do not think it is quite fair to bring this up again after many of the members who voted on the former motion have left the hall. They supposed that this matter was

settled ; and I think it is due to those who were here and voted upon the motion and supposing the question was settled have left the hall, not to take further action at this time.

THE PRESIDENT—As the motion has been seconded I cannot help putting it.

MR. JENKINS—I entirely agree with Mr. Lansden, and I move that we do now adjourn.

THE PRESIDENT—I hope that the motion for adjournment will not be pressed, because there are other matters which should be brought forward before adjourning.

MR. JENKINS—I will withdraw the motion.

THE PRESIDENT—Now if Mr. Egner will withdraw his motion for re-consideration until some other matters have been acted upon, we can then allow him to make the motion, and it can be put with propriety. Will you, Mr. Egner, withdraw your motion for the time being, and allow some other matters to be attended to?

MR. EGNER—Certainly I will withdraw it. I only desire to give each member a chance to express himself.

MR. SHELTON—I wish to make a motion of thanks to Secretary Slater. He has had about the hardest row to hoe this last year of any Secretary that we have had. No matter what our judgment may be as to some of the questions that have agitated us, I know that we all appreciate the greatness of the work he has undertaken, and the efforts that he has made to carry out successfully the instructions he has received from the Council. It is not Mr. Slater's personal views, but it is the instruction of the Council that he has been trying to carry out. He has made a hard and conscientious effort to carry out those instructions ; and I think it is extremely ill-fitting in the Association to depart without expressing by vote the thanks of the Association to Mr. Slater, for his earnest and conscientious work in carrying forward this matter.

MR. EGNER—I second that motion.

THE PRESIDENT—It has been moved and seconded that the cordial thanks of the Association be tendered to our worthy

Secretary for the arduous and efficient services performed by him in behalf of the Association. Those in favor of that motion will rise. Mr. Slater, I have very great pleasure in presenting to you the unanimous vote of thanks of the Association for your services.

MR. HARBISON—I once had the honor of serving for a portion of the year (sickness preventing me from completing it) as President of this Association, and I know what it means to attempt to fill that position. I rise for the purpose of moving that the thanks of the Association be tendered to President Pearson for the very able manner in which he has performed the duties of his office for the year now drawing to a close, and for his quiet and gentlemanly bearing towards, and courteous treatment of, every member of the Association. And I venture to express the hope that he may be long spared to us as a member of the Association; and that when he retires from his present honorable position and returns to the ranks as a high private, we may still see his smiling face among us.

THE SECRETARY—Gentlemen, you have heard the motion, and all in favor will please stand. All are standing. Mr. President, you have witnessed the vote.

THE PRESIDENT—I assure you, gentlemen, of my very hearty appreciation of this manifestation of your good will, and of your kindly recognition of my very humble services. I undertook the duties of President of this important Association, with a good deal of trepidation. I assure you that if with any degree of propriety I could have declined to occupy the position—much as I valued the honor bestowed—by reason of a sense of my own unfitness to occupy it I certainly should never have accepted it. But, thanks to your very kind over-looking of my frailties and failures, I have got through. But more than anything else I am thankful for the assurances that I enjoy the friendship and esteem of so many gentlemen for whom I entertain so high an esteem myself. I desire also to thank the Committee of Arrangements for their recognition and courteous consideration of the two or three British subjects who have the honor to belong to this Association; and I thank them for placing the flag of our country where it should be—along side of

your own. (Great applause) I sincerely hope that these two countries may ever be found standing side by side, hand in hand, walking together in amity, and striving to make this world a better world than it ever would be without them.

I believe there is another matter which Mr. Egner wishes to move before we adjourn.

MR. EGNER—We passed a motion of sympathy about four hours ago, and before this discussion came up, to the widow of one of our most respected members; and while we give this tribute to those who have passed away, I think we should also remember the living. I move that a message be sent to our honored member, Mr. Joseph R. Thomas, who is confined at home by sickness. I think that such a message will be very highly appreciated by him.

MR. LITTLEHALES—I second the motion. (Carried).

The Secretary subsequently sent the following telegram :

WASHINGTON, D. C., October 18th, 1894.

JOSEPH R. THOMAS,

Care American Gas Light Journal,
32 Pine Street, New York, N. Y.

The American Gas Light Association in convention this day sends to you hereby very best regards, with sincere wishes for your speedy and complete restoration to health.

Very truly,

A. B. SLATER, JR., *Sec'y.*

MR. GRAEFF—I gave notice yesterday that I had a resolution to offer to-day; and in offering it I would like, if not out of place, to make one reply to the very sensible remarks of our Secretary. I do not wish in offering a resolution of this kind to be considered as backing water; for although opposed to the scheme of Federation my opposition was not from any fear that it would work injury to the technical gas press. My position towards the present Quarterly Proceedings is well enough known; and whatever some so-called gas men may have to say about it does not bother me much more than the remarks of Mr. Cox did Gen. Butler, in this city some years ago. I believe that our Proceedings should be published in the Quarterly Proceedings, and to make that complete and more emphatic I offer as a resolution, that no paper shall be read before this

Association at any of its meetings that has not been previously published in the Quarterly Proceedings.

THE PRESIDENT—Does anyone second that motion?

MR. HARBISON—I second the motion for the sake of knowing what it all means. I second the motion in order to bring it before us.

MR. LITTLEHALES—I think that would be a great mistake. If all the papers are printed beforehand you may be publishing and putting in permanent form the very thing that you will object to. I do think, however, that the Council should exercise the powers vested in them and investigate those papers fully before they are submitted.

MR. GRAEFF—It is understood that every paper presented here has been previously presented to, read, and considered by the Council. But we all know that when the Council comes to a meeting there is such a mass of business before it that the papers are too often read only by titles; and because a man is supposed to be all right, and a good fellow, his paper is passed by the Council. Now no paper can ever get into the Quarterly without having been read, and carefully considered, and passed upon: The sole object of my motion is to prevent the presentation of any paper that has not been carefully considered and passed upon by the Council, and to prevent the Council in the rush of business from passing papers without due consideration.

MR. HARBISON—I think the position taken by our friend Mr. Littlehales, is good and sound; and I think that such matters are well placed in the hands of the Council. That is what we appoint the Council for. It is not necessary for us to express our individual opinions as to the proper course to be pursued when we have a Council in whom we have confidence, and in whose discretion and judgment such matters rest. I move an indefinite postponement of the resolution.

THE SECRETARY—Before that motion is seconded I would like to say that hereafter the Secretary will, whenever it is possible for him to do so, be only too glad to have a copy sent to each member of the Council, and be read and considered carefully by him, before being published in the Quarterly, or any-

where else. I think that would cover the point that Mr. Graeff desires.

MR. GRAEFF—I second Mr. Harbison's motion. I am satisfied.

THE PRESIDENT—Will you put the motion in the shape you want it?

MR. HARBISON—My motion is that we indefinitely postpone the consideration of the resolution. The explanation of the Secretary clears the way. (Carried).

MR. CLARK—I move a hearty vote of thanks to the Committee of Arrangements.

MR. HARBISON—I second the motion.

THE PRESIDENT—It is moved by Mr. Clark and seconded by Mr. Harbison that the hearty thanks of the Association be presented to the Committee of Arrangements for the very excellent entertainment they have afforded us during our stay in this city. (Carried).

MR. CLARK—I now renew my motion, that the thanks of the Association be tendered to the Federation Committee for the intelligent way in which they have managed their question, and for the labor they have put upon the report; and that the Committee be discharged.

MR. GRAEFF—I second the motion. (Carried).

MR. ADDICKS—I would like to make a few remarks, if in order. I want to express my satisfaction with the close attention given by members to the question of Federation, and my appreciation of the evident interest that was taken in the subject; and I want to say that, personally, I am very glad that we did not come to the question of adoption of the report by a small vote. That would have been extremely unsatisfactory not only to myself but to many other members of the Association. At the same time if they had attended the meeting they would have had ample opportunity to vote for or against the scheme; and their failure to do so I think indicates an indifference on their part on the question of Federation. Those who have remained here have manifested their interest in it; but I repeat

that I am very glad the report of the Committee was not adopted by a close vote.

The Association then adjourned.

REPORT OF COMMITTEE ON PRESIDENT'S ADDRESS.¹

NEW YORK, Dec. 12, 1894.

The Committee on the President's Address beg to report, that in the performance of its duty it finds that while the address of our President is an able review of the condition of our business at this time, and of great value in directing the attention of gas makers to the good work that is yet to be accomplished in the advancement of our interests in the direction of gas sold for purposes other than that of illumination, and again in calling our attention to the growing danger of injurious legislation by town and State authorities, there are no special recommendations made requiring your action, other than a cordial and general endorsement of the address as being thoroughly sound in attitude and its views clearly presented. All of which we respectfully submit.

For the Committee,

WM. HENRY WHITE, *Chairman*.

COPY OF LETTER REFERRED TO ON PAGE 308.

NEW YORK, January 22, 1895.

MRS. GEORGE A. MCILHENNY, Washington, D. C.:

My Dear Madam.—THE AMERICAN GAS LIGHT ASSOCIATION by unanimous resolution directed that a letter, expressing the high and affectionate esteem in which it held your husband, Mr. George A. McIlhenny, should be sent to you, and the grateful duty of writing such a letter was placed upon me. I therefore, in this more formal manner, renew what I have already said to you during the meeting of this Association, held last October, in Washington.

Mr. McIlhenny so profoundly influenced the business in which he was a prominent leader, that his name is widely known and his friendship was appreciated all over our country, and no more lasting monument could be erected, now that he is no longer working with us, than we find in the hearty and affectionate recollections of his fellow workers.

There was neither jealousy nor narrowness in his business life, and that mental broadness which made him successful in his undertakings won the loving respect of friend and rival alike.

I present to you in the name of this Association its respectful regards, and the assurance that the name of George A. McIlhenny will not fade from our memory, nor his record as a manager cease to be an incentive to us all.

I remain, Dear Madam, very respectfully,

WM. HENRY WHITE.

¹ See page 307.

In Memoriam.

Thou hast also established them for ever and ever :
Thou hast made a decree which shall not pass.

FRANK H. DYER,

Salt Lake City, Utah.

Died March —, 1893.

THOMAS C. HOPPER,

Philadelphia, Pa.

Died February 23d, 1894.

FREDERICK A. SABBATON,

Troy, N. Y.

Died April 14th, 1894.

JOHN H. KNOWLES,

Richmond, Va.

Died May 5th, 1894.

PAUL S. MERRIFIELD,

New York, N. Y.

Died May 12th, 1894.

Thou shalt keep them, O Lord,
Thou shalt preserve them from this generation for ever.

Neurology.

THOMAS C. HOPPER.

BORN NOVEMBER 21, 1826. DIED FEBRUARY 23, 1894.

Thomas C. Hopper was born at Biddenden, County of Kent, England, on November 21, 1826. His education was acquired in the local school of his birthplace, and on attaining his majority he engaged in mercantile business. Like many others of his time, America and her opportunities induced him to try his fortunes in another land, and the spring of 1851 found him settled in Philadelphia, where he again engaged in the drygoods business, with Messrs. John W. Covell & Co., whose shops were at Seventh and Chestnut streets. His relations with that firm were dissolved in 1852, an opportunity to engage in the gas meter manufacturing concern of Code, Hopper & Co., having presented itself. The manufactory of this Company, it may be remarked, was located on Fifteenth and Filbert streets, directly back of the present great depot of the Pennsylvania Railroad Company. In 1853 he went to Lynchburg, Va., as an assistant to a Mr. Larkins, who was interested in the construction of the Lynchburg gas works, the main contract for which was held by the then well known gas works constructing firm of Perdicaris & Hoy. On the completion of the works Mr. Hopper remained in charge of the plant for two years as its Superintendent. Returning to Philadelphia in 1855, he re-entered the employment of Messrs. Code, Hopper & Co., looking after the interests therein of his cousin, Mr. William Hopper. For the next few years the growth of the gas business in this country was little

short of phenomenal, and the meter making industry kept pace with that development ; in fact, many new ventures in the industry were made, and this multiplication naturally caused friction. In 1863, after many conferences, the American Meter Company was formed, the parties to the union being Messrs. Down & Merrifield, of New York City, Messrs. Code, Hopper & Co., of Philadelphia, and Messrs. B. H. Gratz & Co., also of Philadelphia. Mr. T. C. Hopper was appointed to the responsible position of General Superintendent to the Company, and performed the duties thereof with exactness and success up to the year 1877. In that year he was chosen President of the Company, an office that was held by him up to April, 1887, when he declined a re-election, having determined to retire from active connection with the business. He, however, remained a Trustee of the Company to the end. Mr. Hopper had large interests in many gas works, notably in the plants at Beloit and Wausau, Wis.; Ionia, Mich.; Gainesville, Tex.; Clarksville, Tenn.; Spokane, Wash.; Lawrence, Kas., and Butte City, Mont. He was elected a member of the American Gas Light Association at the meeting in October, 1876, and while never very prominent in its management, had often contributed much of value to its discussions, and had been, prior to his retirement from active business, a frequent attendant at its meetings. He was possessed of much inventive and mechanical skill, and, although of a naturally retiring disposition, was a man of firm friendship and of rigid integrity. His surviving family comprise his widow and five sons. The latter are all identified with the gas business, Mr. William H. Hopper being the present Vice-President of the American Meter Company. He died at his home in Germantown, Philadelphia, February 23d, 1894. The funeral services were held in Germantown, on the morning of February 27, the officiating clergyman being the Rev. John B. Faulkner, D. D., of Christ Church, Germantown. The pall bearers were John McIlhenny, H. K. Day, H. B. Amerling, P. F. Hagar, John C. Dixon and William Barnes. Interment was made in Mount Vernon Cemetery.

(For the matter in the above, we are indebted to the *American Gas Light Journal*.)

FREDERICK A. SABBATON.

BORN MARCH 16, 1830.

DIED APRIL 14, 1894.

Frederick A. Sabbaton was born in New York City, on March 16, 1830, and at the age of eighteen mastered the then art of telegraphing, making practical use of that knowledge in the office of the Superintendent of the Philadelphia and Reading Railroad, at Mount Carbon, near Pottsville, Pa. In 1851 he took charge of the gas works at Poughkeepsie, N. Y., as Superintendent, and in the following year opened a gas fixture store in Elmira, N. Y., at which time his brother (Joseph A.) was engaged in constructing the Elmira gas works. In 1854, in conjunction with his brother, Joseph A., he erected the Cohoes (N. Y.) gas works, and the year following we find him engaged in working up the ammoniacal liquor from gas works, the apparatus for which was in buildings located on the corner of 18th street and 10th avenue, New York. In 1856 he took charge of the Middletown (Conn.) gas works, remaining there for a year. In 1857 he built the gas works at Northampton, Mass., and in the following year completed the Albion (N. Y.) plant, and also put down the pipe system for the supply of Fredonia, N. Y., with natural gas. In 1859 he built the Brockport (N. Y.) works, following which operation he went to Brooklyn to assist in the construction of the works of the Citizens Gas Light Company. His brother Tyler was then in charge of the Citizens works as Engineer. In 1860 he finished a small works at Saugerties, N. Y., the proprietor of which was Mr. George H. Kitchen, and also completed a small gas plant for the owners of a hotel at Kingston, N. Y. In 1861 he built the Jamestown (N. Y.) works, in which enterprise the late General Charles Roome was largely interested. In 1862 he accepted the position of Engineer and Superintendent to the Troy (N. Y.) Gas Company, a post that he filled with much success and from which he retired (1890) because of failing health. While with the Troy Company he did much outside work, as the following record will attest. In 1862 he built a small plant to the order of the Harmony Mills proprietors, Cohoes, N. Y.; in 1863 constructed the

East Albany (N. Y.) works; and in 1864 built a new plant for the Cohoes Company and also the works at Little Falls, N. Y. In 1868-9, in conjunction with his father and Messrs. Gale, Lockwood & Block, he engaged in the manufacture of aniline colors, which business was subsequently sold out to an Albany firm. In 1872 he was largely instrumental in the organizing of the People's Gas Light Company, of Albany, N. Y., and acted as Engineer to the enterprise, also sharing with the late Henry J. Davison the contracts for its buildings. In 1879 he built a new works for the Hoosick Falls, (N. Y.) Gas Light Company, and in the same year was elected a Trustee of the American Meter Company; a position held by him until 1888. At the time of his death he was President of the Glens Falls, East Albany and Whitehall Gas Light Companies, and was also a member of the Directorate of the Albion Company. This record shows how closely deceased was identified with the gas interest, more particularly in respect of its development in this State, and it can be truthfully said that his restless energy well repaid him. He may be said to have inherited his engineering talent, for his father (Paul A. Sabbaton) was a prominent engineer of New York in the time of Robert Fulton, whose friend and co-worker he was. Deceased was elected to membership in the American Gas Light Association at the 1873 meeting, and some years ago was a prominent figure at its meetings, and was also a charter member of the Society of Gas Lighting. In 1869 he became united in marriage to Miss Mary Follette, of Brockport, N. Y., who survives him, as do two sons—Paul and Frederick A., Jr. On April 14, 1894, he succumbed to a long and tedious illness, and death closed his earthly career. The funeral services were held in Troy on the Tuesday following his death, the Rev. Mr. W. R. Freeman, Rector of St. John's Church, officiating, and interment was made in the Troy Rural Cemetery. The passing from earth of Mr. Sabbaton marks the death of an accomplished engineer whose contemporaries were never slow to acknowledge his ability, and who accorded him the respect due to an honorable man.

(For the matter in the above, we are indebted to the *American Gas Light Journal*.)

JOHN H. KNOWLES.

BORN DECEMBER 3, 1815.

DIED MAY 5, 1894.

John H. Knowles died on May 5, 1894, after a lingering illness of several months. He was born in Dublin, Ireland, on December 3, 1815, but his parents brought him to America when he was but a year old. Richmond was the city of their adoption. There he was reared and educated, and there he resided till the day of his death. No one to the manor born could have loved Richmond with a greater devotion than did he. His noble heart with every pulsation thrilled with a loyal attachment for the scene of so many sacred memories and treasured experiences.

When twenty-two years old he was appointed by Governor McDowell master armorer and chief artificer at the State armory. He retained this position for eighteen years, during all of which time he was highly esteemed by the State authorities and won the hearty friendship of the officers of the Public Guard. His next position of responsibility was that of City Gas Inspector, the duties of which he discharged satisfactorily from 1850 until 1866, when under the reconstruction *regime* he was deposed. He was elected Superintendent of the City Gas Works in 1870. He held this office till about 1886 when owing to the machinations of politics he was supplanted by another. During his incumbency the Gas Works were conducted with strict economy and with such business forethought and attention to details that they annually yielded a handsome revenue to the city. In fact, the yearly reports of Mr. Knowles demonstrated that the income thus derived was greater during his administration than during that of any one of his predecessors. But the public with its characteristic ingratitude did not appreciate his untiring efforts and conscientious performance of duty. At the time of his demise he was an assistant in the office of his son, Wm. P. Knowles, the present Gas Inspector. The deceased rendered much service to Captain, afterwards General Dimmock, in equipping the Virginia troops at the time of the John Brown raid although he was not then in the employ of the State.

On August 11, 1844, Mr. Knowles was married to Miss Sarah F. Crutchfield, a daughter of Ralph and Mary A. Crutchfield, and sister of the founder of *The Baltimorean*, the late Andrew F. Crutchfield. Mrs. Knowles died December 18, 1892, greatly lamented. They had eleven children, of whom five sons and one daughter are now living.

The funeral took place from Centenary Methodist Church on the afternoon of the Monday following his death, the bearers being Judge S. B. Witt, Messrs. J. S. Grimes, W. C. Adams, A. Lyon, R. B. Mumford and Dr. W. H. Scott, also Messrs. Isaac Goddard and W. D. Toler from Union Lodge of Odd Fellows, of which deceased was a member.

Mr. Knowles was of a genial disposition which made him a great social favorite. He was generous to a fault, and his hospitality was of the old type, unbounded and sincere. His energy was untiring, and his courage was dauntless. His impulsive nature made him quick to resent an injury, but his magnanimous spirit made him equally ready to forgive. Malice was a trait unknown to him. He possessed a phenomenal memory. This enabled him to make his letters to *The Petersburg Express* (published by Mr. Crutchfield) and to *The Baltimorean* very entertaining. His personal reminiscences were varied and extensive.

He was elected to membership in the American Gas Light Association, on October 15, 1879, and although not a regular attendant at its meetings was well and favorably known to many of the members.

It is a consolation to those whom he has left to mourn his departure, to know that he died in the faith of the Christian religion, acknowledging Christ as his Saviour.

A whole-souled man has been called from earthly scenes, but his memory will long be cherished, not only by the immediate family, but also by hosts of sympathizing friends who had learned to appreciate the warm heart that ever responded to the appeals of the needy, and pulsated with love for his family, his friends, and the land of his adoption.

(For the matter in the above, we are indebted to *The Baltimorean*.)

PAUL S. MERRIFIELD.

BORN MARCH 3, 1858.

DIED MAY 12, 1894.

Paul Sabbaton Merrifield was born in Albany, N. Y., on March 3, 1858, and was the son of Richard Merrifield (well known in the gas business some twenty years ago) and Josepha Sabbaton, his mother being the daughter of Paul A. Sabbaton, and consequently the sister of F. A., Jos., and Tyler Sabbaton, a trio who made a lasting impression on the gas history of their time. Shortly after the birth of Paul, the Merrifield family removed to New York City, and here the subject of this sketch received a thorough preparation for a course in the Rensselaer Polytechnic Institute, of Troy, New York, from which he subsequently graduated in 1878. Shortly afterwards he accepted a position under his uncle, Mr. F. A. Sabbaton, acting as Assistant Superintendent of the Troy Gas Light Company, which position he most acceptably filled until the close of 1882, resigning from the Troy Company's service to take a subordinate position in the American Meter Company's works, in New York City. His knowledge of the gas business, admirably supplemented by his training at the Polytechnic Institute, well fitted him for his new duties, which at the start placed him under the immediate direction of the Superintendent of Manufactures—Mr. William N. Milsted. His course was such, in the inevitable changes which occur in the management of a large corporation, as to commend him to the notice and confidence of his superiors; and they, in October, 1892, named him to the responsible places of Secretary and Treasurer of the Company, where death found him. Mr. Merrifield's other active connection with the gas business was that of Vice-President and Director in the Glens Falls (N. Y.) Gas Light Company and in the Directorate of the East Albany (N. Y.) Gas Light Company. He was also a member of the American Gas Light Association, which body he joined during the sessions of 1879. In 1891 he was united in marriage to Miss Fannie A. Clarke, of New York City, who survives him, as do two infant daughters. Deceased was a man of reticent disposition, but of kindly ways, and his

memory will live long in the minds of those who were closely associated with him. He died at his home, No. 19 Third Place, Brooklyn, N. Y., on Saturday, May 12, 1894. His demise was startlingly sudden, he having only a day or so before it completed his arrangements to attend the Cleveland sessions of the Western Gas Association; and is to be attributed to acute Bright's disease, developed by a cold. The funeral services were held at his late residence, on the afternoon of the Tuesday following his death, and the interment was made in Greenwood Cemetery.

(For the matter in the above, we are indebted to the *American Gas Light Journal*.)

UNITED STATES PATENTS RELATING TO GAS.

ISSUED SINCE OCTOBER 1ST, 1894.

October 2.

- 526,791.** GAS STOVE. Frederick W. Robertshaw, Pittsburgh, and John M. Cooper, Bellevue, Pa. Filed April 16, 1894. Serial No. 507,689.
- 526,837.** GAS ENGINE. Carl F. Hirsch, San Francisco, Cal. Filed Feb. 20, 1893. Serial No. 463,102.
- 526,955.** REGENERATIVE GAS LAMP. William White, Birmingham, England, assignor of one-half to Thomas Edward Bladon, same place. Filed Sept. 25, 1893. Serial No. 486,472. Patented in England, Nov. 29, 1892, No. 21,775; and in France, Sept. 21, 1893, No. 232,953.
- 526,978.** GAS GRATE. Gottlieb Keller, West Hoboken, N. J. Filed Dec. 26, 1893. Serial No. 494,751.
- 527,012.** HYDROCARBON BURNER. Harvey Cluff, Grand Rapids, Mich. Filed July 13, 1893. Serial No. 480,395.

October 9.

- 527,081.** GAS COMPRESSOR. Benjamin F. Silliman, Cleveland, Ohio. Filed Dec. 12, 1893. Serial No. 493,513.
- 527,085.** CARBURETOR. James O. Sprague and John W. Guthrie, Sacramento, Cal. Filed Feb. 12, 1894. Serial No. 499,946.

October 16.

- 527,397.** GAS BALANCE FOR ASCERTAINING SPECIFIC GRAVITY OF GASES. Max Arndt, Aix-la-Chapelle, Germany. Filed Feb. 18, 1893. Serial No. 462,933.
- 527,566.** GAS BURNER FOR STOVES. Jacob B. Wallace, Erie, Pa. Filed Dec. 14, 1893. Serial No. 493,668.
- 527,567.** COCKS FOR GAS STOVES, &C. Jacob B. Wallace, Erie, Pa. Filed Feb. 8, 1894. Serial No. 499,546.

527,635. GAS ENGINE. Henry Voll, Springfield, Ohio, assignor to John Foos, same place. Filed Feb. 10, 1894. Serial No. 499,715.

527,695. HYDROCARBON BURNER. Berend Kamps, Zeeland, Mich. Filed Jan. 9, 1894. Serial No. 496,273.

October 23.

527,858. GAS STOVE. Abner B. Hutchins, New York, N. Y., assignor to Luther & Lederhos, same place. Filed Sept. 26, 1893. Serial No. 486,516.

528,006. GAS ENGINE. Frank S. Mead, Mòntreal, Canada. Filed Dec. 5, 1893. Serial No. 492,856.

528,063. GAS, OIL OR SIMILAR MOTOR ENGINE. Henry H. Andrews and Alfred R. Bellamy, Reddish, near Stockport, England. Filed March 13, 1894. Serial No. 503,506. Patented in England, Nov. 17, 1892, No. 20,802.

528,105. GAS ENGINE. Henry B. Migliaracca, Napa, Cal., assignor of one-tenth to Siro Migliaracca, same place. Filed March 27, 1894. Serial No. 505,269.

528,115. GAS OR OIL MOTOR ENGINE. Hermann Schumm, Cologne-Deutz, Germany, assignor to the Gas-Motoren-Fabrik-Deutz, same place. Filed Feb. 21, 1894. Serial No. 501,026. Patented in Switzerland, Jan. 3, 1894, No. 7,730; in Belgium, Jan. 5, 1894, No. 107,980; and in Italy, Jan. 30, 1894, LXIX 396.

October 30.

528,344. AIR VALVE FOR GAS BURNER. Henry Ruppel, Cleveland, Ohio, assignor to the Dangler Stove and Manufacturing Company, same place. Filed April 21, 1894. Serial No. 508,537.

528,377. CARBURETER. Ogilvie Moncur, Yuba, Cal. Filed, Aug. 16, 1893. Serial No. 483,257.

528,446. GAS BURNER. Charles H. Robbins, Orvosso, assignor of one-half to S. Dean, Ann Arbor, Mich. Filed Jan. 18, 1894. Serial No. 497,290.

528,449. METHOD OF AND APPARATUS FOR REMOVING WATER OR OIL FROM BOTTOMS OF GAS WELLS. Raleigh H. Staley, Sheridan, Ind. Filed Feb. 23, 1894. Serial No. 501,186.

528,489. GAS ENGINE. James Paterson and William Paterson, Stockton, Cal. Filed June 14, 1894. Serial No. 514,547.

November 6.

- 528,697.** TIME GAS LIGHTING AND EXTINGUISHING APPARATUS. A. B. Shaw, Medford, Mass., assignor to the New England Automatic Gas Lighting Company, Portland, Me. Filed March 2, 1891. Serial No. 383,446.
- 528,820.** METHOD OF CLOSING RECEIVERS CHARGED WITH COMPRESSED OR LIQUEFIED GASES. Emile Stern, Paris, France. Filed Dec. 28, 1893. Serial No. 495,004. Patented in Switzerland, Dec. 9, 1893, No. 7,823; in England, Dec. 15, 1893, No. 24,165; and in Germany, July 2, 1894, No. 75,907.
- 528,836.** MEANS OR APPARATUS FOR EFFECTING AND CONTROLLING THE SUPPLY OF HYDROCARBON TO HYDROCARBON MOTORS. James E. Weyman and James A. Drake, Guilford, England. Filed Nov. 6, 1893. Serial No. 490,175. Patented in England, Aug. 21, 1891, No. 14,133.
- 528,882.** CARBURETOR. Peter Keller, Chicago, Ill. Filed June 14, 1894. Serial No. 514,588.
- 528,888.** GAS BURNER. Peter Keller, Chicago, Ill. Filed July 19, 1894. Serial No. 518,042.

November 13.

- 529,003.** GAS BURNER. Charles Whittingham, Cleveland, Ohio, assignor to the Cleveland Foundry Company, same place. Filed July 18, 1894. Serial No. 517,901.
- 529,262.** WATER GAS APPARATUS. Olaf N. Guldlin, Fort Wayne, Ind. Filed Aug. 14, 1894. Serial No. 520,295.
- 529,313.** ELECTRIC GAS LIGHTER. Charles G. Savage, Philadelphia, Pa., assignor of two-thirds to John L. Ricketts and Grant C. Osborne, same place. Filed June 18, 1894. Serial No. 514,397.
- 529,324.** GAS BURNER. Samuel P. Essex, Zionsville, Ind., assignor of one-half to James O. Hurst, same place. Filed May 4, 1894. Serial No. 510,121.

November 20.

- 529,449.** LIGHTING OR EXTINGUISHING STREET LAMPS. Charles Kervell, San Francisco, Cal. Filed March 16, 1894. Serial No. 503,939.
- 529,451.** COMBINATION GAS AND ELECTRIC LIGHT FIXTURE. Gustav A. Løben, Philadelphia, Pa., assignor of two-thirds to Charles Falkenstein and George Falkenstein, same place. Filed June 7, 1894. Serial No. 513,733.

- 529,452.** GAS MOTOR. Maurice Lorois, Nantes, France, assignor to the Société Anonyme des Moteurs Thermiques Gardie, same place. Filed April 25, 1893. Serial No. 471,754. Patented in France, July 30, 1892, No. 223,360; in Spain, Sept. 7, 1892, No. 13,850; in India, Sept. 9, 1892, No. 257; in England, Sept. 13, 1892, No. 16,413; in Belgium, Sept. 26, 1892, No. 101,511; in Switzerland, Sept. 26, 1892, No. 5,877; in Luxemburg, Sept. 27, 1892, No. 1,696; in Italy, Sept. 27, 1892, XXVII, 32,757; in Cape of Good Hope, Oct. 11, 1892, No. 268; in Victoria, Oct. 21, 1892, No. 10,073; and in New South Wales, Oct. 24, 1892, No. 4,066.
- 529,453.** PROCESS OF MANUFACTURING GAS. Maurice Lorois, Nantes, France, assignor to the Société Anonyme des Moteurs Thermiques Gardie, same place. Filed May 23, 1894. Serial No. 512,219. Patented in France, July 30, 1892, No. 223,360; in Spain, Sept. 7, 1892, No. 13,850; in India, Sept. 9, 1892, No. 257; in England, Sept. 13, 1892, No. 16,413; in Belgium, Sept. 26, 1892, No. 101,511; in Switzerland, Sept. 26, 1892, No. 5,877; in Luxemburg, Sept. 27, 1892, No. 1,696; in Italy, Sept. 27, 1892, XXVII, 32,757; in Cape of Good Hope, Oct. 11, 1892, No. 268; in Victoria, Oct. 21, 1892, No. 10,073; and in New South Wales, Oct. 24, 1892, No. 4,066.
- 529,625.** GAS CLEANER. Thaddeus S. C. Lowe, Norristown, assignor to the Guarantee Trust and Safe Deposit Company, trustee, Philadelphia, Pa. Filed Nov. 28, 1888. Serial No. 292,113.

November 27.

- 529,806.** SUBMARINE PIPE JOINT. Frank Rann, Milwaukee, Wis. Filed March 12, 1894. Serial No. 503,223.

December 4.

- 530,097.** GAS COMPRESSING PUMP. Thomas Farnsworth, San Antonio, Tex. Filed Feb. 26, 1894. Serial No. 501,484.
- 530,139.** GAS STOVE. William A. Food, New York, N. Y. Filed Nov. 21, 1893. Serial No. 491,551.
- 530,161.** PETROLEUM, GAS OR OIL ENGINE. Leonce Crébessac, Paris, France, assignor to the Société Française des Moteurs Crébessac, same place. Filed Aug. 24, 1893. Serial No. 483,940. Patented in France, April 6, 1893, No. 229,185.
- 530,237.** GAS ENGINE. Thomas H. Paul and John T. H. Paul, Frostburg, Md. Filed Dec. 12, 1893. Serial No. 493,457.
- 530,284.** GAS HOLDER. Heinrich Müller, Villencolonie, Grunewald, near Berlin, assignor to August Klönne, Dortmund, Germany. Filed May 12, 1894. Serial No. 511,003.

- 23,854.** GAS STOVE. (Design.) Lazard Kahn, Hamilton, Ohio, assignor to F. & L. Kahn & Bro., same place. Filed Oct. 29, 1894. Serial No. 527,351. Term of patent, 14 years.

December 11.

- 530,508.** GAS ENGINE. Henry T. Dawson, Salcombe, England. Filed May 2, 1893. Serial No. 472,770. Patented in England, April 11, 1892, No. 6,952, and April 11, 1893, No. 7,426; in France, April 8, 1893, No. 229,212; in Belgium, April 10, 1893, No. 104,225; in Germany, April 18, 1893, No. 73,561 and No. 75,328; in Switzerland, April 24, 1893, No. 6,703; in Victoria, May 5, 1893, No. 10,506; in New South Wales, May 8, 1893, No. 4,398; in New Zealand, May 15, 1893, No. 6,187; in Spain, June 26, 1893, No. 14,541; in Italy, June 30, 1893, LXVI, 346; in Austria-Hungary, Jan. 23, 1894, No. 44 and No. 973; and in Canada, May 25, 1894, No. 46,157.
- 530,509.** GAS RANGE OR COOKING CABINET. Frederick C. De Prengal, Washington, D. C. Filed Aug. 3, 1892. Serial No. 442,048.
- 530,523.** GAS ENGINE. Feodor Hirsch, Steinway, N. Y. Filed March 8, 1894. Serial No. 502,815.
- 530,581.** STREET BOX FOR GAS OR WATER PIPES. Frederick A. W. Davis, Indianapolis, Ind., assignor to Elizabeth K. Davis, same place. Filed March 23, 1894. Serial No. 504,785.
- 530,705.** VAPOR BURNER. Edwin G. Mummery, Detroit, Mich. Filed April 27, 1894. Serial No. 509,280.
- 530,887.** STREET BOX FOR GAS OR WATER PIPES. Frederick A. W. Davis, Indianapolis, Ind., assignor to Elizabeth K. Davis, same place. Filed March 23, 1894. Serial No. 504,786.

December 18.

- 530,944.** GENERATOR FOR THE MANUFACTURE OF GAS. James L. Hastings, Philadelphia, Pa., assignor to the National Heat and Power Company, same place. Filed June 14, 1893. Serial No. 477,566.
- 531,123.** AUTOMATIC GAS CUT-OFF. Lewis Johnson and Lewis Fridlund, Willmar, Minn. Filed May 9, 1894. Serial No. 510,646.
- 531,144.** APPARATUS FOR THE MANUFACTURE OF GAS. Walter A. Allen, New York, N. Y. Filed Aug. 6, 1894. Serial No. 519,609.
- 531,182.** COMBUSTIBLE VAPOR ENGINE. Ralph B. Hain, Grand Rapids, Mich. Filed June 1, 1894. Serial No. 513,195.
- 531,282.** CHARGING APPARATUS. Ernest Solvay, Brussels, Belgium. Filed Nov. 10, 1890. Renewed Nov. 14, 1894. Serial No. 528,755. (No model.) Patented in Belgium, July 2, 1890, No. 91,114; in England, July 3, 1890, No. 10,721; in France, July 19, 1890, No. 207,081, and in Germany, July 31, 1890, No. 55,811.

- 531,289.** HYDROCARBON BURNER. Charles E. Cookerly, Kansas City, Mo., assignor of one-half to Frank F. Schmidt, same place. Filed March 5, 1894. Serial No. 502,383. (No model.)

December 25.

- 531,509.** OIL OR GAS BURNER. Colin W. Claybourne, Indianapolis, Ind. Filed Nov. 6, 1893. Serial No. 490,153.
- 531,530.** GAS RETORT. Thomas Hennessy, Grand Forks, N. D. Filed March 6, 1894. Serial No. 502,581.
- 531,537.** MEANS FOR PUMPING LIQUIDS FROM GAS PRODUCING WELLS. John S. Klein, Oil City, Pa. Filed Feb. 2, 1894. Serial No. 498,914.
- 531,543.** HYDROCARBON LIGHTING SYSTEM. Burton L. Lawton, Meriden, Conn. Filed Nov. 23, 1893. Serial No. 491,789.
- 531,552.** AIR OR GAS COMPRESSOR. Casper W. Miles, Cincinnati, Ohio. Filed May 15, 1893. Serial No. 474,330.
- 531,597.** LIGHTING DEVICE. Bradford H. Pendleton, Evanston, Ill. Filed Feb. 26, 1894. Serial No. 501,512.
- 531,602.** COAL AND GAS BURNING STOVE OR RANGE. Albert Steckle, Germany, assignor to Walter C. Eymann, Anaheim, Cal. Filed July 20, 1894. Serial No. 518,160. Patented in Germany, Sept. 9, 1892, No. 68,491, and Jan. 26, 1893, No. 71,461.

UNITED STATES PATENTS RELATING TO GAS.

EXPIRED SINCE OCTOBER 1, 1894.

October 2.

- 195,714.** JET PIPES FOR GAS LAMPS. George Johnson, Buffalo, N.Y. Filed May 9, 1877.
- 195,854.** GAS OR LAMP FIXTURE. B. T. Steinhardt, New York, N.Y. Filed Aug. 22, 1877.

October 9.

- 195,998.** TREATING GAS LIQUOR FOR AMMONIA SALTS. Levi S. Fales, Cambridgeport, Mass. Filed April 28, 1877.

October 16.

- 196,196.** GAS REGULATORS. Isaac Cook, St. Louis, Mo., assignor of two-thirds his right to P. M. Clark and B. R. Lippincott, same place. Filed Sept. 3, 1877.
- 196,255.** GAS REGULATORS. John C. Schooley, New York, N. Y., assignor to Jeremiah W. Curtis, same place. Filed Sept. 1, 1877.

October 23.

- 196,801.** REGULATORS FOR GAS AND OTHER FLUIDS. J. E. Lewis, Worcester, Mass. Filed July 7, 1877.
- 196,804.** CARBURETERS. Edmund J. Meredith, Philadelphia, Pa. Filed June 2, 1877.
- 196,849.** GAS BURNER REGULATORS. Eugene Ginss, New York, N. Y. Filed Sept. 14, 1877.
- 196,480.** EXTENSION CHANDELIERS. John W. Carter, Brooklyn, N. Y., assignor by mesne assignments to E. W. Carter, same place. Filed May 11, 1877.
- 196,478.** GAS MOTOR ENGINES. N. A. Otto, Deutz, Germany, and F. W. Crossley and William J. Crossley, Manchester, England. Filed July 26, 1877. Patented in England, June 4, 1877, for fourteen years.
- 196,489.** REGULATORS FOR GAS BURNERS. George L. Shepard, New York, N. Y. Filed Aug. 15, 1877.
- 196,495.** PROCESSES AND APPARATUS FOR THE MANUFACTURE OF GAS. Theodore G. Springer, Louisville, Ky. Filed Aug. 2, 1877.
- 7,928.** GAS LIGHTING DEVICES. George Selden, Erie, Pa., assignee by mesne assignments of P. B. Tyler, Wm. M. Chandler, and L. F. Standish. Patent No. 50,860, dated Nov. 7, 1865. Filed Oct. 16, 1877.

October 30.

- 196,706.** LIGHTING DEVICES. Israel M. Rose, Greenpoint, N. Y. Filed Oct. 26, 1877.

November 6.

- 196,765.** REFLECTORS FOR GAS BURNERS. William E. Prall, New York, N. Y. Filed Oct. 15, 1877.
- 196,872.** EXTENSION CHANDELIERS. John F. Brown, Philadelphia, Pa., assignor to Cornelius & Co., same place. Filed Sept. 20, 1877.
- 196,931.** GAS BURNERS. William G. Pugh, Baltimore, Md. Filed Oct. 10, 1877.

- 196,946.** CARBURETERS. James Stratton, Philadelphia, Pa., assignor to Osborn Conrad, same place. Filed Dec. 14, 1876.

November 13.

- 196,972.** DEVICES FOR ILLUMINATING CLOCK DIALS, SIGNS, &c. Thomas Dickinson, Buffalo, N. Y. Filed Sept. 27, 1877.
- 196,981.** DEVICES FOR LIGHTING AND EXTINGUISHING GAS. Edward Linsley, Cleveland, Ohio. Filed Sept. 13, 1877.
- 197,001.** APPARATUS FOR THE MANUFACTURE OF ILLUMINATING GAS. Thomas Tully, Springfield, Ill. Filed Aug. 9, 1877.
- 197,061.** PROCESSES AND APPARATUS FOR THE MANUFACTURE OF GAS. Myron H. Strong, Brooklyn, N. Y., assignor to Lemuel W. Sewell, trustee for said Strong, Sidney Cornell, Henry M. Pierson, and W. E. Lawton. Filed Oct. 11, 1876.
- 197,062.** PROCESSES AND APPARATUS FOR THE MANUFACTURE OF GAS. Myron H. Strong, Brooklyn, N. Y., assignor to Lemuel W. Sewell, trustee for said Strong, Sidney Cornell, Henry M. Pierson and W. E. Lawton. Filed Jan. 24, 1877.
- 197,151.** DEVICES FOR LIGHTING AND EXTINGUISHING GAS. Edward Linsley, Cleveland, Ohio. Filed Sept. 13, 1877.

November 20.

- 197,202.** VAPOR BURNERS. Henry S. Belden, Canton, Ohio. Filed Sept. 10, 1877.
- 197,268.** GAS BURNERS. Robert Hale, Minneapolis, Minn. Filed Oct. 26, 1877.
- 197,866.** APPARATUS FOR THE MANUFACTURE OF ILLUMINATING GAS. Ignatz Herzog, Ridgefield, N. J. Filed Sept. 13, 1877.
- 197,403.** TIME GAS LIGHTING AND EXTINGUISHING APPARATUS. Titus Powers and J. B. Hulbert, New York, N. Y., assignors to themselves and Isabella M. Gazzan, Jersey City, N. J. Filed Jan. 4, 1877.
- 197,404.** GAS LIGHTING APPARATUS. Titus Powers, New York, N. Y., assignor to himself, J. R. Hurlbert and Isabella M. Gazzan. Filed Feb. 16, 1877.
- 197,420.** APPARATUS FOR THE MANUFACTURE OF GAS. William Smith, Pittsburgh, Pa. Filed Sept. 27, 1877.
Brief—Gas is made from oil.
- 197,424.** CARBURETING ATTACHMENT FOR GAS BURNERS. Christian G. Spengler, Hoboken, N. J. Filed May 23, 1877.

- 197,484.** GAS REGULATORS. John P. Warner, Baltimore, Md., assignor of three-fourths of his right to T. G. Stewart, I. Mitchell and E. Raine, Jr. Filed March 9, 1877.

November 27.

- 197,528.** GAS LIGHTING TORCHES. Edward L. Megill, Brooklyn, N. Y. Filed Sept. 24, 1877.
- 197,604.** HYDROCARBON BURNERS. George W. Coleman, Kalamazoo, Mich. Filed Aug. 23, 1877.
- 7,975.** GAS TORCHES. A. R. Weiss, Brooklyn, N. Y. Patent No. 187,072, dated Feb. 6, 1877. Filed Oct. 17, 1877.

December 4.

- 197,712.** PROCESS FOR MANUFACTURING ILLUMINATING GAS. Henry Aitken, Falkirk, North Britain. Filed April 15, 1875. Patented in England, July 24, 1874.
- 197,771.** COMBINED CLOCK AND GAS REGULATING MECHANISM. George P. Ganster, Reading, Pa. Filed March 14, 1877.
- 197,772.** RAISING AND LOWERING GAS. George P. Ganster, Reading, Pa. Filed March 14, 1877.
- 197,842.** GAS GOVERNORS. William Foulis, Glasgow, North Britain. Filed Aug. 16, 1877.
- 197,879.** GAS LIGHTING APPARATUS. R. R. Moffatt, Brooklyn, N. Y., assignor of one-third his right to C. R. Brower, same place. Filed Oct. 10, 1877.

December 11.

- 197,998.** REGULATORS FOR GAS BURNERS. John Cooper, Boston, Mass. Filed Nov. 16, 1877.
- 198,008.** GAS BURNERS. Thomas B. Dexter, Lynn, Mass. Filed Oct. 23, 1877.
- 198,084.** ELECTRICAL REGULATORS FOR GOVERNING THE FLOW OF GAS TO HEATING APPARATUS. Joseph Davidson, Berlin, Prussia, Germany. Filed Sept. 6, 1877.
- 198,122.** GAS METERS. F. Klingmueller, Prague, Bohemia, Austria. Filed July 23, 1877.

December 18.

- 198,270.** CARBURETERS. William F. Bossert, Brooklyn, N. Y. Filed Feb. 27, 1877.
- 198,804.** STOPS FOR SWING GAS BRACKETS. Ewald Langerfeld, New York, N. Y. Filed Sept. 4, 1877.
- 198,840.** APPARATUS FOR GENERATING ILLUMINATING GAS. Charles G. Brewer, Penn Yan, N. Y. Filed Oct. 28, 1876.
- 198,853.** AUTOMATIC FEED REGULATORS FOR CARBURETERS. Byron E. Chollar, Chicago, Ill., assignor to Safety Carbureter Company, same place. Filed Oct. 24, 1877.
- 198,411.** VAPOR BURNERS. James Musgrave, Cincinnati, Ohio. Filed Aug. 14, 1877.
- 198,438.** GAS APPARATUS. Thomas R. White, Baltimore, Md. Filed Oct. 6, 1877.

December 25.

- 198,650.** GAS STOVES. Zelotes McKinley and Virgil True, Laclede, Mo. Filed Aug. 13, 1877.
- 198,657.** REGULATED VALVES FOR CARBURETERS. Henry W. Merritt, Somerville, assignor of one-half his right to William R. Stearns and William H. Ireland, Boston, Mass. Filed Dec. 8, 1877.
- 198,731.** CARBURETERS. Henry W. Merritt, Somerville, assignor of one-half his right to W. R. Stearns and W. H. Ireland, Boston, Mass. Filed Dec. 8, 1877.

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L. H. & P., XVII-5-368.
- The Matthews Correspondence, (Boston), L. H. & P., XVII-5-393.
- Proposed Ordinance for Opposition Gas Company at Kansas City,
City Ordinance, L. H. & P., XVII-6-475.
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- INCLUDING MATTERS OF CAPITAL, PURCHASE, SALES, COLLECTIONS, ETC.
- Incorporated Institution of Gas Engineers, *Leicester Journal*,
G. E. M., XI-221-46.
- Renting of Gas Engines, *Cassier's Magazine*, C. M., 7-2-183.
- Annual Report Consumer's Co., Toronto, Directors' Report,
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- Analysis of the Carlisle Corporation Gas Accounts, *Gas World*,
G. W., XXI-531-354.
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The Quarterly Proceedings of the American Gas Light Association may now enter into exchange relations with the published proceedings of gas and kindred engineering societies, and all periodical publications relating to the gas industry. Our exchange list already comprises the following :

Transactions of the Incorporated Institution of Gas Engineers.
 Transactions of the American Society of Mechanical Engineers.
 Annual Reports of the Board of Gas and Electric Light Commissioners.
 (Mass.)
 American Gas Light Journal.
 Progressive Age.
 Light, Heat and Power.
 Official Gazette of the United States Patent Office.
 The Stevens Indicator.

The following publications have been received for the Library of the Association :

Proceedings of the New England Association of Gas Engineers for the years 1880-81-82, from C. F. Prichard, Sec'y N. E. A. of G. E.

Year Books of the Society of Gas Lighting for the years 1879 to 1884, inclusive; also Reports of the several Addicks gas agitations in Rhode Island, from A. B. Slater.

Papers of the Western Gas Association, years 1892 to 1894, inclusive, from A. W. Littleton.

Gas in Foreign Countries, Special Consular Reports, 1891, from Honorable The Secretary of State.

The Management of Small Gas Works, C. J. R. Humphreys, 1884; also The Electric Light, Eugene Vanderpool, 1878, and several other papers from the American Gas Light Journal.

Carburetted Water Gas, Jas. Stelfox, 1894, from Humphreys & Glasgow.

Catalogue of Books on Gas and Kindred Subjects, and other pamphlets, from E. C. Brown.

A partial file of the American Gas Light Journal, from the Providence Gas Company.

A partial file of Progressive Age, from the Sec'y, A. G. L. A.

A lot of odd numbers of American Gas Light Journal, Progressive Age, and Light, Heat and Power, materially assisting in filling the files of those periodicals, from Wm. S. Gribbel. New York.

Also, from several other parties were received various pamphlets, photographs of works, etc.

Gas Lighting and Gas Fitting, Wm. Paul Gerhard, C. E., 1894, from D. Van Nostrand Company, New York.

This little book (see our issue July, '94, page 110) deserves special mention

because of its very practical character, being something that every gasfitter and gas company employé could read to advantage.

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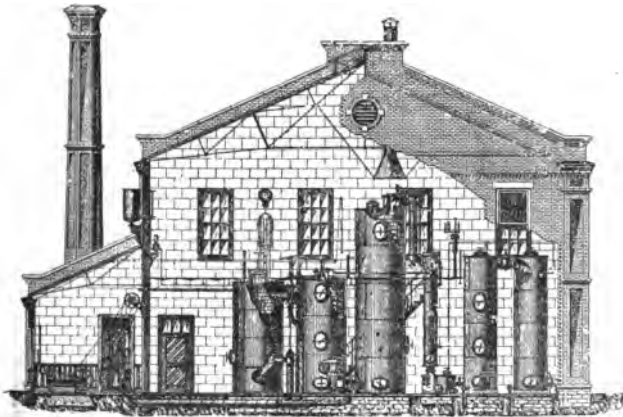
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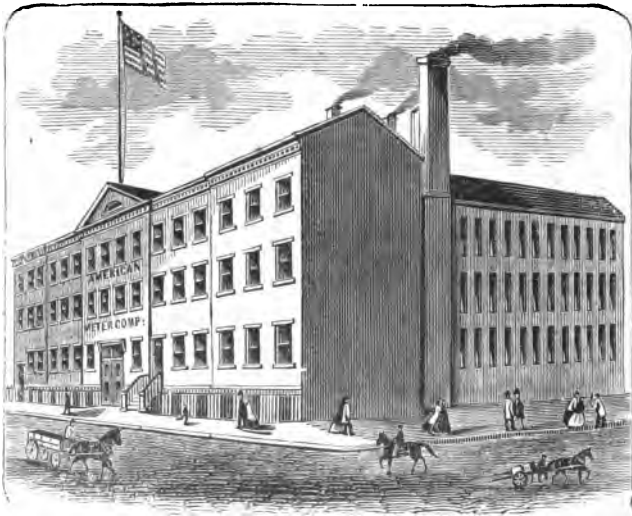
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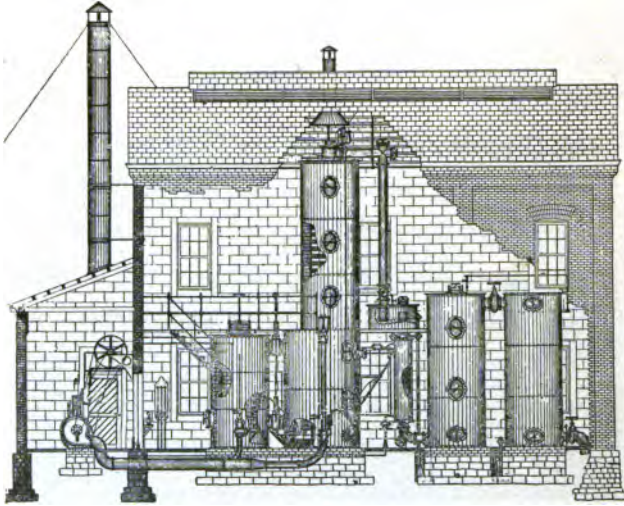
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